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ELECTRICITY IN COAL MINES.

All electric installations have inherent danger characteristics which may, however, be reduced to a minimum by proper care in design, installation, maintenance and operation. In coal mines the conditions are much severer than usually obtain in other work and there is the added danger of explosion of fire-damp or coal dust, as well as an increased hazard from electric shock to the workers on account of the confined quarters in which they have to move about. The dampness of many coal mines and the corrosive effect of the acids often found in mine waters render the question of insulation a very difficult one. This emphasizes the necessity for rigid and continuous inspection, for an insulation which is perfect at the time of installation might become entirely useless in the course of a few months, or even weeks, with the methods at present adopted.

With all these and other drawbacks to the use of electricity in coal mines, it is not astonishing that many mining men still look askance on the new power, especially when failures and breakdowns have been frequent, and accidents out of all proportion to what they should have been. The reason for the latter is not far to seek. Incompetent soi-disant electricians, who perhaps were hardly skilled enough to wire a building, have "rushed in" where prominent electrical engineers would have "feared to tread." No wonder then that failure and disaster have so often resulted. But this is being rapidly changed. Mining and electrical men have realized that the problem is one for the skilled engineer, and that when an electrical equipment is properly designed and installed there can be none safer for use in mines. The problem is a difficult one, but when tackled in the right spirit by the competent man is one capable of very definite solution.

In another part of this issue will be found an abstract of a paper by George R. Ward on "Safe Use of Electricity in Coal Mines," in which some valuable information on the subject is given. Another noteworthy contribution on the same topic was a recent paper by Robert Nelson on "Electricity in Coal Mines," presented before the (British) Institution of Mining Engineers. Mr. Ward's recommendations will be found interesting in comparison with Mr. Nelson's, as showing the parallel progress being made in the two great coal-producing countries.

Mr. Nelson emphasizes the sparking danger, which he considers is largely independent of voltage, and recommends, in order to avoid sparking, that circuits should be made and

broken under oil, or, if this be impracticable (as when using direct current), in properly designed explosion-proof chambers. He strongly prefers three-phase alternating current to direct current for many reasons and considers that the only advantage of the latter is that with its use coal cutters may be employed on the concentric system of working, a method which is at best one of very limited application.

When the mine water will not attack lead, Mr. Nelson recommends lead-sheathed armored cable. The alternative is fiber insulation with a sheathing of vulcanized bitumen. Electrical circuits in mines should be protected by maximum cut-outs in preference to fuses to avoid sparking as much as possible. Even these are not considered safe in all cases, and the use of some protective system is recommended.

The use of unarmored cable, according to Mr. Nelson, is preferably to be limited to cable for portable apparatus and to end connections where there exists no danger from falls or of firing timber work. Porcelain insulators should be used, with sufficient separation of the cable from the surface wired over.

Mr. Nelson deprecates the difficulty, which obtains at present, of obtaining oil-break switches with overload trip coils which will operate on circuits carrying less than 100 amperes. He thought that a reliable oil-break switch with an overload attachment for use on motor circuits of ten horsepower or over would practically do away with fuse boxes on motive-power circuits, besides the consequent greater rapidity and certainty of action in opening circuit. Squirrel-cage motors should be used wherever possible, and transformers for use underground should be oil-cooled. Mr. Nelson recommends earthing the neutral point of each transformer secondary. Motor frames and transformer cases should also be permanently and effectively earthed by stout wires.

TRANSFERRING MACHINERY TO IMPROVE PLANT ECONOMY.

The pursuance of any operating policy to extreme limits often results in losses of efficiency in the generating plant or upon the distribution system. Thus, in some cities all similar apparatus has been concentrated in a single station under the theory that the service will be more reliable when uniform equipment is installed in one place. To some extent this is true, and in addition there is no doubt that the number of spare parts are fewer and the possibility of rapid repairs is greater in case of trouble than where equipment is less homogeneous and more widely scattered. A recent instance from central-station practice, however, shows the importance of considering the efficiency as well as the reliability of the service, in a system where the load is divided between more than one generating station.

In the case in mind, the company supplied its local city lighting service from a waterpower plant located about six miles away from the business center, a steam plant with modern turbo-alternators being operated in the urban district in parallel with the hydraulic station so far as it was necessary to make up the load. The arc machines were located at the waterpower plant, but they were controlled from a switchboard in the city station, which was in some degree a substation of the waterpower installation, with a steam auxiliary. This plan worked very well as long as the supply of water was adequate, but it was found that when the river was low, sufficient power could not be secured from the waterwheels to operate the lighting generators, and as a result it became necessary to transmit current from the in-town station to the hydroelectric plant where a motor-generator was installed to drive the arc machines, the energy being returned to the city circuits over the arc lines. The losses by this method were considerable, without any compensating gain in flexibility. The company therefore decided to remove part of the arc equipment to the in-town station, operating it there by a motor-generator installation available at the time, and cutting out a double line loss with increased service reliability.

EXTENDING TELEPHONE LINES INTO SPARSELY SETTLED TERRITORY.

In the administration of public-service corporations' distributing utilities over wide areas, one of the most difficult problems encountered is the question of extensions into sparsely settled territory. This is clearly a matter where the most expert opinion is needed, to avoid excessive investments in unprofitable service and equipment on the one hand and a stagnation of enterprise on the other. Popular judgment can be of little value in the study of extensions, and wherever it is attempted to regulate developments of this character by untrained agitation, public petitions, and hasty action of municipal authorities, only harm may be expected.

The recent failure of the so-called telephone extension bill in the Connecticut Legislature is a case in point. The measure provided that the Southern New England Telephone Company should be required, on the petition of a certain number of persons, to extend a line into a specified district, no matter how sparsely settled. The judiciary committee wisely brought in an adverse report on the bill, but the House attempted to pass it, failing through the Senate's rejection and remanding of the measure to conference. If this measure had become law, an unfortunate precedent would have been established, since a thorough technical analysis of the cost of an extension, the annual operating and fixed charges upon it, and the immediate and probable revenue is the only sound basis for action. Where service is demanded by widely scattered customers in a territory where a company cannot afford to erect and maintain lines the plan of sharing the construction or maintenance expense with the prospective customer has often worked out favorably. Labor furnished by farmers under proper restriction for line construction and repairs can often be applied at far less cost than when the operating company must assemble and maintain the necessary force. To require a company to make extensions merely upon the presentation of a petition would be unreasonable in the extreme, if not confiscatory.

ELECTRIC DRIVE FOR TEXTILE MILLS.

The electrification of existing textile mills and the installation of electric drive in mills projected or under construction are topics of timely and vital interest in view of the enormous strides this country is taking in the cotton industry. With abundant supplies of raw cotton and comparatively cheap (because efficient) labor close at hand, not to mention the advantages of our enormous potential hydroelectric resources as yet undeveloped, there is no doubt that this country is bound to take in a very short time a leading place among nations of the world in the manufacture of cotton goods.

It is a fitting sign of the times that many of the large cotton mills of Lancashire, the hitherto undisputed leader in cotton manufacture, have already installed electric drive, even when this meant the scrapping of valuable steam machinery; and cotton manufacturers of other countries have not been slow in following their lead.

Two essentials in textile manufacture may be pointed out: (1) The fluctuation of speed of the prime mover must be reduced to an absolute minimum, as very slight variations in speed will result in differences of tension of the yarn or thread sufficient to break it in its passage through the machines. (2) The temperature of the "sheds" or various rooms must be kept at a definite constant level, as must also the humidity, in most cases. This is especially the case in silk manufacture.

Both of these requirements are better met by the electric motor than by the steam engine. Steam engines for textile manufacture are preferably of comparatively slow speed, and consequently are of massive build and expensive to operate, and must be equipped with enormous flywheels and installed with the best of care to reduce speed fluctuation and vibration. With individual drive, motor-driven machines may be kept at almost exactly constant speed, and by suitable provision for ventilation of the parts the temperature rise may be kept within well-defined limits.

In another part of this issue will be found an abstract of an excellent paper on the subject which will well repay a careful perusal to those at all interested in the subject. In one of the greatest power schemes in the South, by means of long-distance, high-voltage transmission lines, and self-contained substations, a very good start has already been made in the electrical driving of textile mills.

REDUCING THE ELECTRIC-RAILWAY TRANSFER ABUSE.

There is little doubt that the street-railway free transfer is one of the most abused privileges in public-utility operation. Traction managers have long appreciated the losses in revenue chargeable to the improper use of the transfer, but the remedy has been hard to find. The prosperity of operating companies granting liberal transfers—in some cases two or three transfers on a single fare—is frequently seriously threatened by the abuses which have grown out of the disrespect which the public feels for that which costs it nothing. The situation is of more than local consequence to the electrical industry, because any illegitimate shortage of revenue means less money available for the purchase of new equipment and the adequate maintenance of existing installations. Fortunately in some instances matters have been improved by the raising of the street-railway fare unit from five to six cents, and where the extra cent has been applied to the transfer alone the results have appeared to be very interesting and suggestive.

Perhaps the best example that has yet come to hand of the effect of a transfer charge is afforded by the thirty-two miles of Newton lines of the Middlesex & Boston Street Railway Company. The management of this organization presented before the Massachusetts Railroad Commission quite recently figures showing the effect of a charge of one cent per transfer issued for a period of ten months compared with the same months of the year before, when all transfers were free. The Commission authorized the company in 1908 to charge the extra cent for each transfer for an experimental period of one year, being satisfied that the earnings and expenses of the road justified such a course. The company has just been authorized to continue the charge for a second year, after due public hearing in which, strange to say, no one appeared to raise an objection to the charge. The regular fare unit on this system remains at five cents.

The company's figures show a remarkable reduction in the transfer abuse as a result of the extra charge. The company's gross receipts on its Newton lines were $287,799 for the 1909 period and $285,688 for the corresponding 1908 period. There was no charge for transfers in the 1908 period. The passengers carried were 6,284,241 in 1909 and 6,434,602 in 1908, but the number of transfers issued were, respectively, 549,159 and 733,733, showing a reduction of 184,574 transfers, or twenty-five per cent, after the establishment of the charge. The significant figures, however, are those of the transfers turned in by the conductors, being 531,125 in 1909 and 623,556 in 1908, showing that before the transfer charge was instituted over 110,000 transfers were not redeemed in transportation by passengers asking for them and that after the extra cent was imposed only 18,000 transfers, or one-sixth as many, were thrown away or lost. In other words, eighty-five per cent of the transfers issued were used when they were free and ninety-seven per cent were used after the extra charge was made. The number of passengers carried per transfer issued was 8.8 in the free-transfer period and 11.5 in the year when a cent more was the price for each check given out. These figures show that a real abuse has been considerably checked, and while the patronage of the lines shows little improvement, matters are on a much sounder basis than before. Whatever growth comes now will be on a solid footing. Doubtless the charge of an extra cent on a street railway, whatever the cause, is a deterrent of traffic to some extent, but in the long run the value of a good service will outweigh such a temporary disadvantage.

DETAILS OF WATT-HOUR METER MANUFACTURE.—II.

BY JOSEPH B. BAKER.

TOP BEARINGS.

The top bearing in many types of meter consists of a simple hole drilled in a brass plug, which is secured by a screw-thread or by a set-screw, forming a guide for a journal, consisting of the top of the shaft turned down to very small diameter.

The top bearing of Westinghouse meters (see Figs. 7 and 8 in the last issue) is different, in that the journal is a fixed pin, running in a lubricated bearing hole in the top of the shaft. The journal consists of a brass screw, tapped into the shield with careful alinement, as described elsewhere, with a piece of 0.023-inch diameter steel piano wire forced into its lower end. The free end of this journal is rounded and polished, and the journal is trued up with the screw by the same method that is employed for the staff of the register gears, as described elsewhere.

FIG. 10.—ROTATING ELEMENT WITH SPHERICAL ARMATURE.

The top of the meter shaft is fitted with a bearing in the form of an accurately drilled hole, below which is a larger hole containing disks of billiard-cloth soaked in oil. The tip of the bearing just touches these disks, so that effective lubrication is maintained and rust prevented, by capillary attraction.

THE ROTATING ELEMENT.

General Features in the Two Principal Types of Meter.—The various parts that go to make up the rotating element of modern direct-current and alternating-current meters are all designed for minimum weight consistent with the necessary strength and their proper functioning.

One of the greatest advantages of the induction meter over the commutator meter of the same watt-hour capacity is the lightness of the rotating element of the former, obtained by the elimination of the wound armature and the commutator, and the shortening of the shaft thus made possible.

The commutator meter obviously cannot be designed to have as light a rotating element (see Fig. 10) as the induction meter, in which the damping disk is itself the driving armature. Great improvements have been made, however; for example, the weight of rotating element in one of the older T R W commutator meters was 255 grammes, whereas the weight of the present type C-6 T R W rotating element is stated to be only ninety grammes. This reduction in weight has been secured mainly by substituting aluminum for copper in the disk, by using a tubular shaft instead of a solid one, and by changes in the material and construction of the armature core.

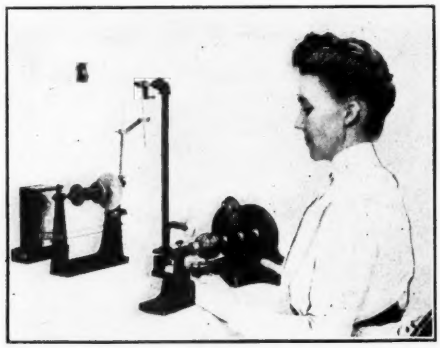


FIG. 11.—METHOD OF WINDING SPHERICAL ARMATURES.

The parts of the rotating element that are common to direct-current and alternating-current meters are the shaft, with or without removable pivot, the disk fixed thereon, and the driving member (worm or pinion) at the top. The removable pivot used in most makes of modern commercial meters, both direct-current and alternating-current, have already been described, under Step Bearings.

The Shaft and Driving Member.—The shaft, in the best forms of commutator meters, consists of a hollow steel tube with very thin walls, fitted at its upper and lower ends with solid plugs, which the shaft may be swaged down to receive. The lower plug may itself be pointed, hardened and polished to constitute the shaft end, or pivot, of the step bearing, or may be threaded to receive a removable pivot. The upper end of the shaft is shouldered down for the commutator and worm, and may be finished at the top as a spindle of small diameter, constituting the journal member of the top bearing. The placing of the worm at the top of the meter shaft meshing with the worm wheel (the "first drive"), for transmitting the motion of the shaft to the register, is characteristic of most modern meters.

The shaft of the Fort Wayne Electric Works meter is a composite one, consisting of three sections securely forced together. The short top section and the bottom section are of leaded brass, and the middle section of steel rod. The top and bottom sections are turned down for part of their length and the steel rod is drilled out at either end, and the three sections are then forced together and the whole machined to size. The worm is cut in the leaded-brass section at the top and a hardened steel pin forming the top bearing is driven into the same. The bottom section is drilled and tapped for the insertion of a separate brass stud containing the hardened steel pivot. This form of construction is stated to give a strong shaft, with top and bottom sections of metal, which is easily worked.

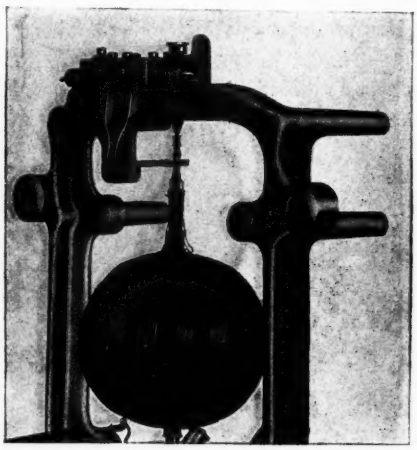


FIG. 12.—MOUNTING OF SPHERICAL ARMATURE.

A typical form of shaft worm and worm-wheel pair is that for the T R W meter, consisting of a worm of hard-drawn brass rod meshing with a worm wheel of hard rolled clock brass, the gear ratio being 100 to one for all meters. The parts are stated to be "properly made and highly polished to insure absence of friction."

A notable departure from the above construction is made in the Westinghouse meters, with their ball-jewel step bearing,

fixed-journal top bearing, and pinion at top of shaft, described at greater length elsewhere.

The Disk.—Disks of commercial meters are now of aluminum, except in special cases where it is necessary to obtain the highest possible conductivity. Copper was exclusively used in the early types of meters, on account of its high conductivity, giving the necessary "drag," and owing to the fact that the production of aluminum was not then upon a commercial basis.

The use of copper for disks of the old T R W meters gave low speeds and correspondingly high disk constants (not lower than one-half). Later it was decided to increase the speed by an amount corresponding to the lowering of the constant limit to 0.2, which permitted the use of a disk of somewhat lower conductivity. It was possible to lower this damping effect in two ways—either by decreasing the thickness of the standard copper disk, or by using aluminum, which at that time had come into commercial use and was known to possess a conductivity about one-third that of copper. Aluminum disks were tried, and to compensate for the loss of conductivity were made somewhat thicker, the total loss, however, not being more than permitted by the lowered meter constant. It was found that aluminum was very satisfactory in every respect, and possessed the great advantage of being nearly four times lighter in weight than copper.

To add to the stiffness of the aluminum disk, and thereby prevent buckling by accidental blows, etc., in transportation or service, it is often stamped in shallow ribbed or corrugated form. Disks so made are claimed to be stiffer and stronger than an uncorrugated disk of twice the thickness.

General Electric meter disks, in meters of both the commutator and induction types, are made with two good-sized holes, diametrically opposite each other, between the center and edge of the disk. These holes are primarily intended to stop creeping of the disk, in the induction meter; but serve also, in the manufacture of disks for both alternating-current and direct-current meters, to drive the disk while the edge is being "trued up" in the shop.

The Shaft and Disk of the Westinghouse Induction Meter.—The rotating element of the Westinghouse induction meter, complete, weighs approximately fifteen grammes. This extreme lightness is due to the use of a short and light shaft and a thin disk of small diameter. The shaft is of phosphor-bronze, gold-plated like the register gears.

The disks for these meters are blanked out on a punch press from over-size circles of aluminum approximately 0.023 inch thick. The same operation makes the corrugations on the disk which give it the necessary stiffness. The disk and its hub (see Fig. 7) are then assembled and machined on a turret machine, as follows:

1. The hub blank, held in a revolving chuck, is turned down to diameter—a driving fit on the center hole of the disk.
2. With chuck standing still, the disk is forced on the hub; and with chuck revolving, the edge of the hub is spun over on the bottom surface of the disk.
3. Shaft hole in hub countersunk.
4. Shaft hole drilled.
5. Shaft hole reamed.
6. Edge of disk turned down to final diameter (four inches), and edge rounded and polished.

After the disk has been assembled on its hub, it goes to a bench to be "trued up." This operation is performed by a skilled workman, who mounts the disk on its own shaft, places it in a standard jewel bearing, and twirls it about under an even illumination, bending it gently and carefully this way and that between his fingers until it runs sensibly true on its shaft. The complete rotating element—disk and shaft—is then balanced, by rolling it on knife edges. When the heaviest part is thus determined, the lightest part (diametrically opposite) is weighted by putting on the under side of the disk, with a brush, a spot of dead black lacquer. This "spot" is not to be confused with the "counting spot," which is on the top of the disk near the edge.

Armatures.—The armatures of direct-current meters have undergone great improvements in the direction of reduced weight and bulk, by new methods of manufacture—a spherical armature (see Figs. 10 and 12) wound with film-insulated or "cellulose acetate" wire on a papier-maché or leatheroid shell or core having replaced the old T R W style armature of rectangular shape, wound with silk-insulated wire on a "spider." There are, of course, a large number of the latter style of armatures still in use.

The armatures may be wound by girls, on a winding machine, like the one shown in Fig. 11. Each machine is equipped with a clutch for holding the armature core and a counter for counting the number of turns wound on. The same machine is used for winding shunt-field coils.

The armature of the type C-6 meter has eight coils, of film-insulated wire, wound by an automatic winding machine on a molded leatheroid core. The film-insulated wire, by its superior space factor, allows the armature winding to be gotten into a relatively small space; and the spherical form of the complete armature permits it to be embraced closely by the field coils, so that high torque is secured with relatively low losses.

Commutators.—The commutator of the direct-current meter, along with other of its details, has been much improved in recent years in the direction of reduced diameter and weight, and general design. Thus, in the type C-6 T R W house-service meter of all capacities, it is 0.1 inch in diameter, and has pure silver segments secured to a supporting rod by lashings of silk. In the Westinghouse direct-current meter it is 0.154 inch in diameter, and has pure gold segments.

The type C-6 commutator is assembled upon a rod of high-grade steel, which is subsequently forced into the upper end of the tubular shaft, the latter having been reduced, or "swaged down," to receive it. In building up the commutator upon the rod, the latter is first insulated by a coat of enamel. Over this is placed a winding of silk, and the rod is then japanned and baked. The eight commutator segments, cut from wire of pure silver, of uniform cross-section, are placed in position on the rod by the aid of a small assembling jig. The ends are then tied down by silk tie bands, and the commutator is again japanned and baked. Next the commutator is turned down, using a sapphire turning tool, which gives the best results in this delicate operation. Finally, the japan is carefully cleaned from between the segments, giving in effect an air-insulated commutator at the part where the brushes bear upon it. Notwithstanding the small size of the structure, it gives superior insulation to that of the former T R W meter commutators, which were mounted upon fiber cores. The great advantage gained by the new small-diameter commutator is, of course, the reduction of commutator friction that is attained. This is said to be proportional to the reduction in the diameter of the commutator, thus resulting in great improvement in light-load accuracy.

RESISTANCE CARDS.

The non-inductive resistance that is placed in series with the armature in

commutator meters is made up in various forms, such as a flat "card" in a protecting envelope, and a tube, enameled and baked.

The necessity of having the temperature coefficient of the armature circuit in a direct-current meter equal to that of the disk is due to the fact that, in order to maintain the calibration unchanged un-

FIG. 13.—DAMPING MAGNET FOR T R W METER.

der temperature changes at the location of the meter, the energy expended in the armature and field must be balanced (neglecting C^2R and friction losses) by the energy absorbed in the braking of the disk by the damping magnets. General rise of temperature in the room in which the meter is located will produce a certain percentage of increase of resistance in the armature circuit, tending to slow down the meter; but if the disk is of a metal having the same temperature coefficient as the armature circuit, the rise of temperature will increase its resistance to the eddy currents (generated by the motion of the disk through the field of the damping magnets) in the same proportion, which will tend to allow the disk to be driven faster. These two tendencies will just balance each other, and the speed of the disk for a given load will be constant under local temperature changes.

Modern commutator meters have an armature wound with copper wire. The

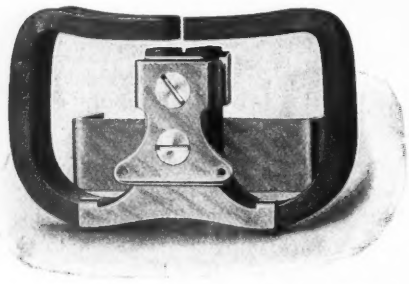


FIG. 14.—MAGNETS FOR TYPE C INDUCTION METER.

resistance in series with the armature is, in some meters, composed of a certain number of ohms of tinned iron wire and about one-fourth this amount of German silver, in order to make the temperature coefficient of the armature circuit as a whole equal to that of the aluminum disk. Since copper has about the same temperature coefficient, iron a much higher, and German silver a much lower temperature coefficient than that of aluminum, the equalizing of the temperature coefficients of the armature circuit and of the disk is only a question of proportioning the amounts of iron and German silver wire in the circuit. If copper were used throughout for the armature circuit, it would introduce no serious error, but it would be too bulky and expensive.

In some modern meters—the type C-6 T R W meter, for example—the shunt-field coils and resistance are in one, as described under Fields of Commutator Meters.

BRUSHES.

The new "gravity-control" brushes are superseding the spring-control brushes that were formerly employed in commutator meters. Each brush is mounted on a pivoted holder, so arranged that the pressure of the brush on the commutator is given by the weight of a small adjustable counterweight, consisting of a pair of knurled thumb-nuts, on a threaded rod, supported at right angles to the brush-holder. This counterweight can be adjusted quickly and accurately, and locked in the position to give the tension on the brushes that is best adapted to the local conditions of vibration, etc. The device gives equal tension on the two brushes, and on each individual leaf of each brush, since in adjusting the device the brushes are left in the original straight shape in which they come from the factory inspection of the meter. The making of a spring adjustment of the brushes, required with the old arrangement, and always a delicate and "fussy" operation to the most experienced meter inspector, is thus eliminated. Fig. 12 shows the gravity-control brush arrangement for the type C-6 T R W meter.

The "gravity-brush" arrangement is really an effective combination of gravity and spring contact, on account of the elasticity of the brushes. The latter are often of silver, either in the form of two-fingered flat strips or in the form of plain round wires. Or they may be phosphor-bronze wires carrying silver contact pieces.

DAMPING MAGNETS.

The need of having the non-friction load in the meter, given by the damping magnets, large relatively to the friction load, and equally constant, is an accompaniment of the use of high torque in meter design. To fulfill these requirements means, concretely, that the damping magnets must be both strong and permanent—a combination of properties the realization of which has required the exercise for many years of the utmost patience and skill in devising processes and in selecting and specifying material.

FIG. 15.—TESTING MAGNETS WITH MAGNET-MEASURING MACHINES.

Fig. 13 is a view of an old-style T R W meter magnet in its shoe, ready for mounting on the base of the meter. Fig. 14 is a view of the magnets and heavy brass magnet shoe of a Westinghouse type C induction meter, in position looking from

the front of the meter. In alining the magnet system in the shoe so as to make the system interchangeable in different meters, the shoe is put on the magnets with the two heavy flat-head screws, that hold the parts of the shoe together, not set up tight, and the clamping lugs open. Then the magnet and shoe are put on a meter shield and the magnets are adjusted in the shoe in the right position, with their air gaps alined with the air gap between the shunt and series field cores, the screws are set up tight, and the clamping lugs are bent over under pressure to grip the magnets firmly.

The shoe carries at the back a U-shaped brass yoke, slotted at the ends for the light-load adjustment of the meter. The shifting of the damping magnets to effect this adjustment for the Westinghouse induction meter is described elsewhere as a detail of the factory calibration.

The two small holes at the bottom of the front plate are tapped for the meter name plate.

Fig. 14 shows also very clearly the shape of this magnet, used on all meters of Westinghouse make. The air gap is approximately three-thirty-seconds inch—one-thirty-second inch shorter than the gap between the shunt and series field cores.

The best meter magnets are made from a medium tungsten steel of low carbon, which comes to the factory in long, rounded-edge strips of proper width and thickness for magnets. Even under rigid specifications the shipments of steel are liable to vary somewhat in magnetic quality, and in order to insure the production of uniform magnets samples are selected from each shipment to the amount of about one per cent—not at random, but in a way to represent the lot fairly—and put through the same stages of manufacture as the regular product of magnets; with the additional feature that magnetic measurements are applied at each successive step in the process to determine the quality of the lot of steel and the best hardening temperature, or to locate the reason for its failure to meet the requirements.

In the handling of these samples—and of the entire production of magnets made from the shipment, guided by the results on these samples—pieces of the steel are cut of suitable length and bent up into magnet shape at bright-red heat on a "bulldozer" swaging machine. While hot the magnets are stamped with an identifying symbol, to facilitate looking up their individual history at any future time by reference to the complete records that are kept of all treatments and tests. After cooling naturally, the magnets are ground at the ends to proper length, sharp edges and slivers being removed, but no grinding being permitted upon the air-gap surfaces.

After "pickling" for about an hour in a fifty per cent solution of muriatic acid, to remove scale, the forms are ready for the hardening process. The sample magnets are divided into five batches, each of which is brought to a different heat in a gas furnace; the individual forms of each batch being brought to the same temperature, as judged by the eye of the skilled workman. The five heats range from a cherry red to a "white," and the heat that gives the best result under subsequent treatment is selected for hardening the entire shipment of steel. It is considered preferable to use the lowest temperature that will give "glass hardness" to the steel with high tenacity.

It is in the hardening process that the width of air gap is fixed, by using a special pair of tongs, provided with a pin, which is inserted between the jaws of the magnet and against which they are forced in taking the magnet out of the furnace ready for quenching. The magnet, held firmly in the tongs, is plunged into the quenching bath—a strong solution of rock-salt brine, kept at constant temperature—flatwise, to avoid distortion due to unequal cooling.

After a rest of twelve hours the magnets are tested for flaws, and for water or acid checks, by "ringing up," each magnet being struck a light blow or two, the workman rejecting all that do not give out a pure musical note. At this time also the air gap is gauged; all magnets of good general appearance, that allow a steel wire 0.125 inch in diameter to pass freely through their air gaps, but that do not allow a wire 0.150 inch to enter, being accepted.

The magnetizing device consists of an electromagnet, fed from a 110-volt direct-current circuit through a treadle-operated switch, with pole-pieces suitably shaped and spaced to fit closely the ends of the hardened steel form. Upon applying the latter to the poles and exciting the electromagnet, a powerful magnetomotive-force is applied to the steel. An important feature of the device is the use of a rotating copper disk driven at the rate of 3,000 revolutions per minute, the edge lying midway between the poles of the electromagnet. The complete arrangement constitutes a dynamo-electric generator of the disk type. In operation, powerful eddy currents are generated in the disk and give rise to an armature field the reaction of which against the main (exciting) field tends to force magnetic lines radially outward away from the center of the disk. This distortion of the resultant field drives a powerful flux through the steel form, whereas without the use of the rotating disk much of the main flux from the exciting electromagnet would pass directly from pole to pole of the latter without useful effect upon the steel form.

The magnets as they leave the magnetizing machine are supersaturated, *i. e.*, they are in an unstable magnetic condition, ready to lose a good percentage of their strength by ordinary vibration or handling, etc., or by mere lapse of time undisturbed, within a few weeks or months of the date of their magnetization. The next step, therefore, is to apply various artificial "aging" processes whereby the attainment of magnetic stability, or "permanence"—which would ordinarily take years of natural aging, with no assurance of permanence at the end of the period—may be hastened. These processes bring the magnets to a fixed magnetic condition in a few days.

The first treatment is an improvement upon the old academic procedure of aging by boiling. The magnets are hung upon racks in a "boiling machine," arranged to dip the magnets alternately in boiling water and cold water; the latter being constantly circulated and renewed to keep its temperature normal. In this machine the magnets have alternate exposures of about seven minutes each in boiling water and in water of ordinary temperature, there being at least eight complete cycles of this treatment. This process—which, it should be noted, carries the magnets through changes of temperature far in excess of any encountered in actual service in meters—removes about fifteen per cent of the magnetization.

The next aging process—to which the magnets are subjected after twelve hours of rest, followed by a second "ringing up"—is a treatment with steel-wire scratch brushes. This treatment serves the double purpose of subjecting the magnets to strong mechanical vibration, each wire of the brush giving a light hammer blow to the magnet as the brush revolves at high speed, and of cleaning up the surfaces ready for painting. It removes another

fifteen per cent of the total initial magnetization.

The final aging process is the most severe, however, removing twenty per cent of the magnetization. It consists in applying each magnet for a few seconds to a rotating copper disk, eleven inches in diameter, driven at a minimum speed of 2,850 revolutions per minute. The poles of the magnet enclose the edge of the disk so that the latter is traversed by the magnet's field, just as it does under the same construction in the meter. But whereas the disk speed is very low in the meter, at the high speed of this device a strong armature field is set up, the reaction of which demagnetizes the magnet to the extent above stated.

After being painted a durable, glossy black, and air-dried, the magnets are placed in wood-compartment trays and sent to be tested on the magnet-measuring machine.

The form of magnet-measuring machine which the author inspected at the Lynn meter factory of the General Electric Company in 1904, is shown in operation in Fig. 15. This machine, at which two magnet testers may work at the same time, operates by weighing, in arbitrary units, the "drag" due to the reaction between the field of the magnet under test and the eddy currents that are generated in a rotating metal disk enclosed between the magnet poles. The machine consists of a horizontal shaft on which are fixed three similar copper disks. The middle disk has its edge enclosed between the jaws of a magnet of standard strength, carried on a balance frame supported on knife edges, the magnet being permanently mounted at one end of the frame and a fixed weight at the other end. With the disk rotating at a certain speed, the downward drag exerted on the magnet plus the weight of the magnet just balances the counterweight, and holds the frame horizontal. Each of the two other disks, which are, of course, rotating at the same speed as the middle disk, is fitted with a balance frame similar to the one for the standard magnet except that it is provided with a temporary seat for the magnet to be tested, and that the distance of the counterweight from the knife-edge supports is adjustable over a scale. In operation, the tester places the magnet to be tested on her frame, and then adjusts the counterweight till it just balances the weight and drag of the magnet, as above. The testers may note the state of calibration of the machine at all times by the balancing of the standard magnet under the drag of the middle disk—any lack of balance either way indicating that the speed has changed. After obtaining a balance as described, the magnet is removed and the scale reading is recorded —generally in white paint on the inside of the back, near the N-seeking pole.

An improved magnet-measuring machine manufactured by the General Electric Company, operates by comparing directly the speeds of two similar direct-current meters, one meter having a single damping magnet of standard strength and permanently mounted, and the other meter having no permanently mounted magnet, but being arranged so that the magnet to be tested may be slipped in place, enclosing the edge of the disk in standard position. The two meters are mounted in a case, one above the other, with their shafts (which rotate in opposite directions) in vertical alinement and connected together by a small differential gear. The latter consists of a pair of similar bevel pinions placed between, and meshing with, two bevel-gear wheels, fixed, respectively, on the bottom of the shaft of the upper meter (which is equipped with the standard magnet, and which rotates in the counter-clockwise direction) and on the top of the shaft of the lower meter (which is arranged to receive the magnet to be tested, and which rotates in the clockwise direction). With the same load thrown on the two meters, and a magnet to be tested placed in position in the lower meter, if this magnet is of the same strength as the standard, the speeds of the two meters will be the same, so that the pair of pinions in the differential gear, which is driven by the two bevel-gear wheels, will remain in the same position. If, however, the lower meter's disk is enclosed by a magnet weaker than standard, the damping effect on this disk will be correspondingly less, and the disk will run at higher speed than the upper meter's disk, causing the differential gear to revolve in the clockwise direction; and if the magnet under test is stronger than the standard, it will damp its disk down to a lower speed than that of the upper disk, causing the differential gear to revolve in counter-clockwise direction.

In the actual construction of the apparatus, the standard meter runs on constant load, but the load on the lower meter is arranged to be varied by an adjustable calibrated rheostat, by means of which its speed can be made equal, for any strength of magnet enclosing its disk, to the speed of the standard meter; resistance being cut in to compensate for a magnet weaker than standard, and cut out to compensate for a magnet stronger than the standard. The observer always notes through a window in the case the direction of revolution of the differential gear, by observing a circular scale, mounted on it, with reference to a fixed index. He then cuts resistance in or out, as may be required, by turning a hand wheel, graduated in percentages of the strength of the standard magnet, till the scale on the differential gear comes to rest. The scale reading of the hand wheel is then recorded as the strength of the magnet under test.

The magnet-measuring machine gives a record, in arbitrary units, of the strength of each magnet; the records serving not only as a guide to the acceptance or rejection of the individual magnets that have reached this stage of the process, but also to give a reading of the strength of each magnet for comparison with a second reading taken after a lapse of three months or less, and as a precaution against error due to personal equation on the part of the operator. In order to determine whether any natural aging or change takes place, following the violent artificial aging processes that have been applied up to this point, the individual records obtained for a batch of magnets are filed away with the batch for the above period.

Such magnets as are found too strong for use in meters are subjected to a fourth aging process by the use of an alternating field. Only about twenty per cent of the magnets require this treatment, which consists in passing the magnet through the core of a coil traversed by an alternating current of controlled strength. Whenever this last demagnetizing treatment is required, its use is always followed by a treatment with the demagnetizing disk; the latter weakening the "drag" of the magnet still further, probably by a rearrangement of the magnetic lines in the steel.

The magnets that pass successfully to this point in the process are sorted according to strength, ready for mounting in the various types of meters.

As showing the high quality of steel required for the making of these meter magnets, it is stated that only about two per cent of the shipments received have to be rejected, and that at the conclusion of the processes of hardening, magnetizing, and aging, above described, the magnets are strictly "glass hard," and yet are so tough that they cannot be deformed, broken or perceptibly reduced in magnetization by extremely rough usage. For example, in mounting each magnet in its brass holder, or clamp, for use in the meter, the fingers of the holder are hammered into place on the magnet (always on the side of the N-seeking pole) without altering the strength of the magnet in the slightest degree. The magnets can be subjected to heavy blows, and their jaws can be forced apart by a cold chisel through a distance eight or ten times as great as their original separation without snapping the steel, the jaws coming together again, when released, with a very small permanent set.

[To be continued.]

LOSSES, INDUCED VOLTS, AND AMPERES IN ARMOR AND LEAD COVER OF CABLES.[1]

BY H. W. FISHER.

PART III.

CALCULATION OF IMPEDANCE, ETC.

A graphical method may be used for determining the conditions existing when the armor or lead circuit is completed. The conditions required to be known are the reactance and resistance of the conductor and of the secondary circuit. These may have been measured or calculated.

Refer to Fig. 8. The following construction has been made: OA is parallel to the X-axis and is equal to the conductor resistance; AC is parallel to the Y-axis and is equal to the conductor reactance (this may be calculated by formulas 11 and 14); BC is equal to the reactance of the secondary circuit and can be determined by formulas 12 and 14. The circle CPB has been drawn on CB as a diameter; BG has been drawn equal to BC, the reactance of the secondary circuit, and GF equal to r, the resistance of same. BF cuts the circle CPB at the point P.

Then OP is the impedance of the conductor when the secondary circuit is closed, OC being the impedance when this circuit is open. As r is varied, the locus of the point P is on the semicircle CPB, and it may readily be seen that the impedance may be greater with the sheath connected than when it is open. The effective resistance is $OA + BH$, the effective reactance $AB + HP$. BF is the impedance of the secondary circuit; the current induced in it, per ampere in conductor (see formula 7), is equal to $CB + BF$. If there be another secondary circuit beneath, whose reactance is CI, the voltage induced on it is equal to IP. If the current coil of a wattmeter be in series with the main conductor and the volt coil be connected to the terminals of this circuit, the reading will be the watts lost in the closed secondary circuit.

In the case of an iron-armored cable, where there is considerable loss, it is impossible to calculate accurately the conditions, but the following method has given results in fairly close agreement with actual tests. The open-circuit conditions must have been measured, or calculated from observations on another cable.

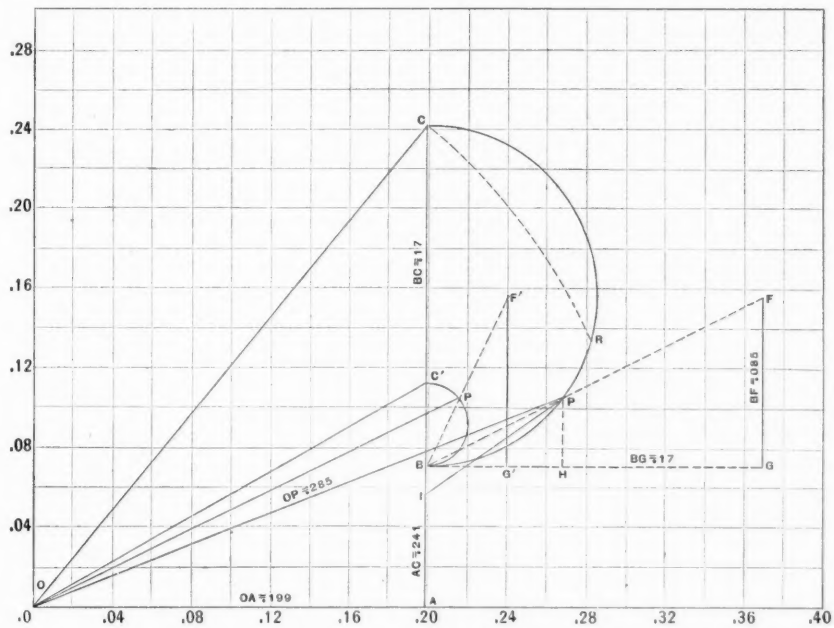


FIG. 8.—GRAPHICAL DETERMINATION OF IMPEDANCE.

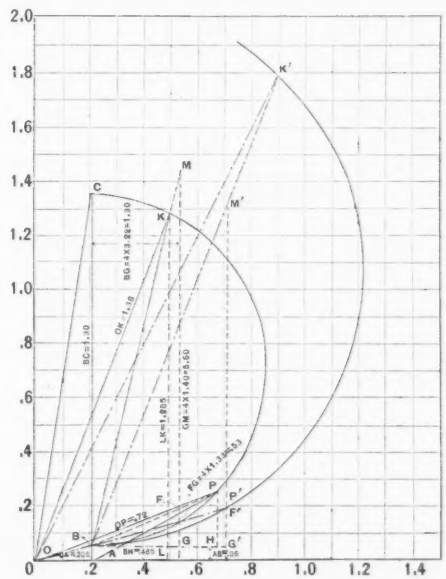


FIG. 9.—DIAGRAM FOR IRON-ARMORED CABLE.

The construction is as follows: Refer to Fig. 9. OA = conductor resistance; AB = reactance between sheath and conductor, and may be calculated by formulas 13 and 14; OL = loss when secondary circuit is open; OK = impedance. Circle BKC is constructed, its center being on BC. $BG = BC$. In the diagram as constructed it was necessary to draw BG, GM and BM, one-fourth size, on account of the great length of GM. This affects no other lines or points. GM is perpendicular to OL. Draw BKM, cutting MG in M. Then OK is the impedance which would have resulted had there been an imaginary completed circuit of reactance BC and resistance GM surrounding the conductor so as to have a reactance between itself and the conductor = AB. This assumption is actually far from true. A large part of the loss, probably one-half or more in the tape-armored cable, is due to hysteresis. The excuse for the method is that errors in calculation based on it are less than the variations would be between two cables made to the same specifications. For the remainder of the calculation, consider this imaginary circuit in parallel with the sheath when the latter is connected. The point P may be located as before, OP being the impedance of the cable. The voltage induced in the lead on open circuit is BK. The current is determined as before, except that the whole current ($= CB/CM$) may be supposed to divide between the two in accordance with the resistances.

It may be noted that the accuracy of any method for calculation of the performance of an iron-armored cable is somewhat reduced, due to the fact that the reactance voltage caused by the iron is far from a sine wave.

In demonstrating the correctness of the construction for the cable without iron the following facts[1] are made use of: (1) The effect of current flowing in a tube, on the magnetic field, is the same at any point outside the tube as if the current in the tube were concentrated in a conductor at the axis of the tube

[1] Abstract of a paper presented before the annual convention of the American Institute of Electrical Engineers, Frontenac, N. Y., June 29, 1909.

[1] See "A Treatise on Electricity and Magnetism," by J. Clerk Maxwell. Third edition, Vol. II, page 316.

(2) The effect on the field at any point inside the tube is zero.

From (1) it follows that the electromotive-force induced in the tube is the same, whether the current be flowing in the tube or in a conductor at the axis of the tube.

The effect of non-uniform distribution of current in the tube when the cables are near each other has been neglected. This effect should be of about the same magnitude as that of the eddy currents, produced by current in the conductor when the necessary circuit is open. This latter is, in general, not of great importance.

Let Current in conductor $= I$.
$a + b =$ reactance of conductor.
$a =$ reactance of tube (lead or armor).
$a\,I =$ volts induced in tube when tube circuit is open.
$r =$ resistance of tube.
$r_1 =$ resistance of conductor.
$C =$ current induced in tube.
$C_1 =$ component of C in phase with I.
$C_2 =$ component of C at right angles to I.
$V =$ voltage.
$V_1 =$ voltage in phase with I.
$V_2 =$ voltage at right angles to I.
(V, V_1 and V_2 induced by the flux which cuts both the tube and the conductor, when the tube circuit is completed.)

Now, since the induced voltage is at right angles to the current producing it and is equal to the product of that current by the reactance of the circuit,

$$V_1 = C_2 \times a \quad \ldots\ldots (1)$$
$$V_2 = (I - C_1)\, A \quad \ldots\ldots (2)$$

Then since V_1 and V_2 are the voltages induced in the tube by the combined action of the current in the conductor and in the tube itself, the current induced is equal to the voltage divided by the resistance, and is in phase with the voltage producing it, or

$$C_1 = V_1/r \quad \ldots\ldots (3)$$
$$C_2 = V_2/r \quad \ldots\ldots (4)$$

From equations (1), (2), (3), and (4), we obtain—

$$C_1 = \frac{a^2}{r^2 + a^2} I \quad \ldots\ldots (5)$$

$$C_2 = \frac{a\,r}{r^2 + a^2} I \quad \ldots\ldots (6)$$

$$C = \frac{a}{r^2 + a^2} I \quad \ldots\ldots (7)$$

$$V_1 = \frac{a^2\,r}{r^2 + a^2} I \quad \ldots\ldots (8)$$

$$V_2 = \frac{a\,r^2}{r^2 + a^2} I \quad \ldots\ldots (9)$$

$$\frac{V_1}{V_2} = \frac{a}{r} \quad \ldots\ldots (10)$$

If I is put equal to 1, these values are in ohms, volts and amperes. The impedance of the conductor equals the vector sum of V_1, V_2, b and r.

If r be eliminated between equations (8) and (9), we get an equation between V_1 and V_2, which is that of a circle constructed on the line "a" as a diameter. This, with equation (10), confirms the correctness of the graphical construction. It is possible to calculate the conditions existing when two secondary circuits of different reactances and resistance are connected in parallel, but the formula is very complicated, and is of the fourth degree. It is much simpler, and generally would be very closely approximate to assume a single circuit having a reactance of about the average of the two. This will always give values of total loss somewhat lower than the true loss.

Having given the performance of one armored cable with the secondary circuits open, that of another of different dimensions may be easily determined nearly as closely as one of the same dimensions, provided only that the size of the armor and the method of construction be the same.

Let a_1 = diameter through center of armor of the measured cable, a_2 = same diameter on cable whose performance it is desired to calculate, at a current = C. Then the loss of apparent power in the second cable at C amperes caused by the armor is equal to a_2/a_1 times that of the first at $C\ a_1/a_2$ amperes. The loss to be used in the calculation is the total loss in the cable less the conductor C^2r. To get the impedance due to the armor, subtract from the total impedance (vectorially) the conductor resistance and the reactance calculated for cables of the same size at the same separation without armor. More accurately, that part of the reactance which is produced by the space that would be occupied by the armor should not be subtracted. Neglecting this will make an error of about five per cent in the reactance.

The formulas used to obtain calculated results given in this paper are as follows:

Inductance of a cable:

$$L = l\,\frac{15.24 + 140.5 \log_{10} d/r}{10^9} \quad (11)$$

where l = length of cable in feet; d = distance between centers; r = radius of conductor.

For tubes:

$$\text{Inductance} = l\,\frac{140.5 \log_{10} d/r}{10^9} = L \quad (12)$$

This is strictly true only for an infinitely thin tube.

Inductance of a circuit consisting of a tube and solid conductor =

$$L = l\,\frac{15.24 + 140.5 \log r_1/r}{10^9} \quad \ldots (13)$$

r_1 being the radius of the tube.

$$\text{Reactance} = 2\,\pi\,f\,L \quad \ldots\ldots (14)$$

where f = the frequency.

In Fig. 8 the construction resulting in the determination of the impedance OP was for the 1/0 copper-armored cable, distance between centers being eighteen inches. The impedance OP' is that of the same cable, the distance between centers being one-and-five-tenths inches. Both of these impedances were determined with the armor short-circuited at each end of the cable.

The construction of Fig. 9 is based on a conductor current of 300 amperes and twenty-four inches between centers of the steel-tape-armored cable. The incompleted semicircle $BF'K'$ is the construction for 156 amperes. It is interesting to note the relative increase of reactance compared with ohmic resistance, which is much greater in Fig. 9 than in Fig. 8.

Massachusetts Electric Light Association.

At the twentieth annual meeting of the Massachusetts Electric Light Association, held at the Tedesco, Swampscott, Mass., on Thursday, July 29, the officers of the association were re-elected, as follows:

President, C. L. Edgar, Boston.

Vice-presidents, A. B. R. Sprague, Worcester; C. F. Pritchard, Lynn.

Secretary, Everett W. Burdette, Boston.

The twentieth anniversary of the association was made the occasion of a special paper by Secretary Burdette, who reviewed the history of the association and the influence which it had exerted in behalf of the central-station companies of Massachusetts. Forty-seven members, representing forty-two companies, were present at the first meeting, which was held in Boston in 1889.

The report of the executive committee indicated that municipal ownership was becoming more and more a dead issue, and legislation hostile to Massachusetts central stations had been entirely absent during the past year.

Prof. Elihu Thomson was the guest of honor at the annual dinner, and in response to President Edgar, delivered a brief address devoted to the great advance which was possible through the reduction of cost to small consumers.

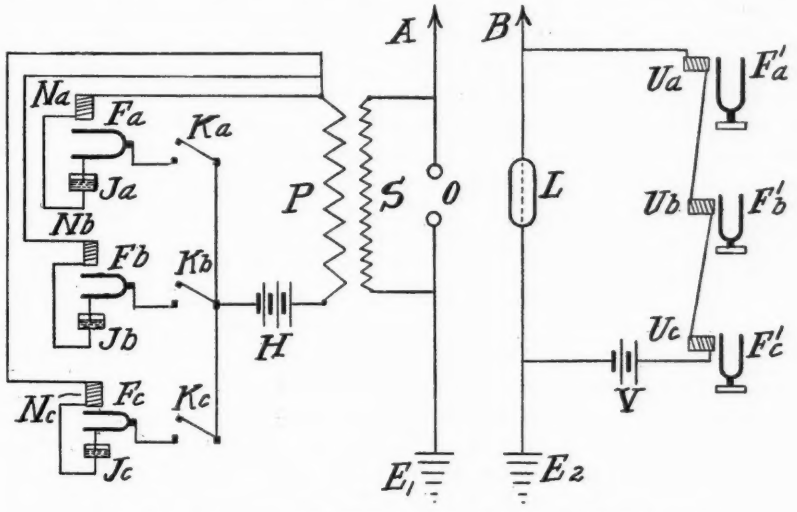
Acoustic Method of Tuning for Wireless Telegraphy.

In a system for selective wireless communication, invented by John H. Cuntz, of Hoboken, N. J., and recently patented, instead of the usual electrical tuning, the syntonization is accomplished by mechanical and acoustic methods.

When the customary transmitting apparatus of a wireless-telegraph system is set in operation, electromagnetic waves, with frequencies of the order of, say, 1,000,000 per second, are propagated. These waves, being started by the oscillatory discharge at a spark gap, decay rapidly, so that the number of waves due to a single original impulse is comparatively small, and the period of activity of these waves is only a small fraction of a second. If these impulses, instead of being given in a haphazard way, are regularly timed at definite intervals, groups of high-frequency electromagntic waves will be propagated, and by means of suitable transmitting apparatus, these wave groups may be made to have any convenient periodicity, or frequency, of a lower order than the electromagnetic-wave frequency. For instance, these groups may be given the frequency of audible tones, of the order, say, of 100 or 1,000 per second, each group being composed of a comparatively few electromagnetic waves of the order of 1,000,000 per second.

Now, if at the receiving station there be placed a suitable acoustic and mechanical receiving apparatus which will respond only to wave groups with frequencies of a definite pitch, such apparatus will select and receive messages from only those transmitting stations which send out wave groups of this same frequency, and will not be affected by any others.

One of the methods that Mr. Cuntz has devised for carrying this out is illustrated in the accompanying diagram, the left-hand side of which shows a transmitting equipment and the right-hand side a receiving equipment, each containing a number of corresponding selective devices. A and B are antennæ grounded, respectively, at E_1 and E_2. P and S are the primary and secondary of an induction coil, the secondary of which is connected across the spark gap 0. The primary is connected through a source of current H with a number of electromagnetically actuated tuning forks, F_a, F_b, F_c, each having in series with it a key, electromagnet and mercury cup designated



ACOUSTIC METHOD OF TUNING FOR WIRELESS TELEGRAPHY.

for the upper fork by K_a, N_a, and J_a, respectively, and by corresponding letters for the other forks.

Connected across the sensitive receiving device L at the right side of the diagram is a set of electromagnets, V_a, V_b, and V_c, in series with a source of current V and actuating a set of tuning forks F_a', F_b', F_c', corresponding to those of the transmitting apparatus.

In operation each tuning fork, when it is actuated by its electromagnet, makes and breaks its circuit by mechanical contact with solid contacts or, preferably, by means of a small rod or needle point dipping into a mercury cup. Since the forks in the transmitting apparatus are in separate parallel circuits, each one is in vibration only while signals are actually being sent. The different circuits can be operated either separately or simultaneously, without interfering with each other. When they operate simultaneously, they can send out signals to different receiving stations, or they can send a combined signal, composed of a number of tones, or a chord, or even a combination of sounds which will form articulate speech, to one or more receiving stations.

In the receiving apparatus the current in the local circuit changes every time a wave group strikes the responding device. A tuning fork is placed in proximity to the solenoid or electromagnet, so that when the magnetic field of the latter is changed at regular intervals corresponding to the natural rate of vibration of the tuning fork, the latter will begin to vibrate and sound its characteristic note. There may be as many tuning forks, of various pitches, at a receiving station as is desired, each being of the same pitch as a corresponding tuning fork at a transmitting station. Each tuning fork is controlled by an electromagnet or solenoid, and these electromagnets may be in series with each other, or they may be in parallel. These tuning forks can operate singly or simultaneously. When they operate simultaneously, they can receive signals from different transmitting stations at the same time, or they can receive a combined signal, composed of a number of tones, or a chord, or even a combination of sounds which will form articulate speech, from one or more transmitting stations.

The apparatus and method described are merely typical of the general principles of Mr. Cuntz's invention. Among some of the modifications are the substitution of other means for either mechanically or electrically interrupting the transmitting circuit and of various devices for receiving the Hertzian wave impulses. In all cases, however, there is included in both the transmitting and receiving circuits a set of corresponding tuning forks or equivalent devices for separating out particular wave groups of the wireless impulses. There can also be combined with it means for graphically recording the impulses sent out and received.

Interurbans Carrying Mail.

Most of the interurban electric-railway systems are making arrangements to carry the United States mails. The compensation is low, but the distribution of mail in this way with its prompt and more frequent delivery is popular in the rural communities.

Safe Use of Electricity in Coal Mining.[1]

Owing to recent disastrous explosions in coal mines, many of which were attributed to dust produced by motor-driven machines, some interesting statistics were compiled of the amount of dust produced by various mining methods. One set of figures, from results obtained at the mines of the Washington Coal and Coke Company, Connellsville, Pa., gave 1.80 pounds of dust (screened through a forty-mesh screen) per square foot undercut, for hand mining; 4.58 pounds for puncher machines; 1.48 pounds for chain machines with pick-pointed bits. Results from two other mines gave 6.18 pounds for the puncher machine, and 2.43 pounds (2.51 pounds at one trial) for the chain machine with standard chisel bits. With regard to the danger of igniting fine dust by electricity, it was pointed out that electricity in itself will, of course, not explode, and will not arc except when a circuit is broken. In a mine generating explosive gas in large quantities it is advisable to keep all electrical wires, and, so far as possible, electrical apparatus, on the intake air, for obvious reasons.

Discussing the danger of high-potential electric currents, the author considered that the higher voltages, as of 500 volts, to which a large number of plants have in recent years been changed, usually from 250 volts, were far more dangerous than the lower voltage. Proper methods of resuscitation of persons who were shocked by the electric current would prevent many fatalities, and instances were given in support of this contention. Particulars were given of the efforts being made in Pennsylvania to draft a new mine law to diminish the possibility of electric shock. A committee of operators and electrical manufacturers was appointed to confer with the commission which was appointed by the governor to draft such a law.

Returning again to the question of safety of the men, it has been considered useless for some years past to insulate electric wires underground, since there seemed to be no commercial insulation which was of value after a few years' use, or in some cases, a few months' use. It has, therefore, been preferred to use bare wires, even for machine lines in room headings, and depend on the miners' intelligence to recognize the danger of a bare wire. In this connection it is interesting to note that at the testing station of the Geological Survey in Pittsburg the electrical department is making some experiments on various insulations subjected to extreme mining conditions. Cables with rubber and other insulations are submerged in acid mine water, readings taken of their initial insulation resistance, and these readings repeated at frequent intervals. The weakness of the insulation will be shown by the gradual or sometimes sudden drop in these values.

An insulation called varnished cloth or varnished cambric, tested at this station, has been used by the author under mine conditions, and has been subjected to severe service for over two years, without any sign of trouble. This does not seem to be affected by acid and is perfectly moistureproof. The cost of this insulation will, it is believed, be considerably less than the best rubber, and if the results obtained at the testing laboratory measure up to those found in practice, the author believes it will be only a short time until it can be confidently recommended that all machine wires carrying 500 volts or over be insulated, where carried on room headings.

Bare wires can, of course, be used where the wires are carried through air courses or off the traveled roads. So far as the trolley is concerned, it is out of the question to consider protecting this for its entire length. At all places, such as partings, turnouts, and where the traveling roads cross the haulage road, the trolley wire can be protected by means of a trough or a single board projecting below the level of the trolley and firmly supported from the roof. In a large number of mines, all branches from the main trolley, on which but one locomotive works at a time, are sectionalized by the use of automatic trolley switches, which cut the current off the branch except when the locomotive is working thereon.

It has been found by experiment that in many mines where the rails are in contact with the earth and the headings are wet with acid moisture, part of the return current, amounting in some cases to sixty per cent, is carried by the earth. Electrolysis in the pipes parallel and near to the track is caused by the current where it enters and leaves these pipes. In flowing through moist earth from the pipe to the rail it will carry part of the iron of which the pipe is composed into the earth toward the rail. This is prevented by using copper connections for the current from rail to pipe and back.

The use of electric lights in mines is strongly recommended, particularly at partings, turnouts, and all points where men must travel along or across the rails. It is advisable to have more than one circuit where lights are used as danger signals, to provide for burnouts. In some mines red lamps are installed at the danger points and show only when the current is on the wires at the parting.

In all cases where large tracts of coal are to be developed, the author recommends the use of 275 volts potential, using high-tension alternating-current transmission from the central plant, and locating substations as close to the work as possible. Where the cover is excessive, these substations can be located underground at the center of distribution. Wherever the cover is light, it would usually be preferable to have the substations overhead and the direct-current cables taken into the mine through boreholes.

Many mining men are possibly familiar with plants on the three-wire system. In these plants the current is generated by standard railway machines at 550 to 600 volts. The neutral tap is taken off these generators by means of proper connections to the windings from collector rings, and these taps, by means of balancing coils, furnish a neutral lead, between which and either main lead, the potential is one-half that of the generator. Apparatus in the mine is operated between either main lead and the rail, which is the neutral, and the maximum potential which can be received will be 300 volts. Stationary apparatus, such as fan motors, car hauls, large pumps, etc., can, if desired, be operated on full potential, or, if a wide speed range is desired, motors may be operated first on 300 and later on 600 volts.

The wiring in the mine is so sectionalized that an approximate balance of load is maintained between the two sides of the system, and in the case of a perfect balance, the system is equivalent to a metallic-circuit 600-volt transmission, using twice the copper as a grounded return system, or one-half the copper as compared with a 300-volt grounded system.

Where there are a large number of small units operated, such as locomotives, machines and pumps, a close balance may be maintained, and the efficiency of the transmission depends on the balancing, since with total unbalance it will be a straight 300-volt transmission. In actual operation at Ellsworth, Pa., and Minden, W. Va., the average balance is held within fifteen per cent, with an occasional unbalance of twenty-five to thirty per cent.

[1] Abstract of a paper by George R. Wood, presented at the summer meeting of the Coal Mining Institute of America, at Punxsutawney, Pa., June 29.

Convention of the Society of Automobile Engineers; Electrical Papers.

The Society of Automobile Engineers held its summer convention in Chicago on August 5, 6 and 7 last. The first day was devoted to hill-climbing contests at Algonquin, Ill., and a gratifying feature to electrical men was the record of the Babcock and the Columbus electric vehicles. The former car won the electric event, but both cars surpassed the performances of some of the gasoline cars.

Among the papers presented there were several of interest to electrical men.

INCREASING WEIGHT EFFICIENCY OF STORAGE BATTERIES.

Dr. Edward Sokal, consulting chemical engineer, Chicago, read a paper entitled "Possible Increases of the Weight Efficiency of Storage Batteries." The author discussed the attempts to increase the output per unit of weight, and said that in his opinion improvement in this direction would probably not be attained by substituting different chemical materials than those of the lead battery. He criticized Edison's battery and pointed out that the result of eleven watt-hours per pound of element attained in this battery can be exceeded by the lead storage battery. Improvement in storage batteries since the days of Planté and Faure had been mainly along the lines of manufacturing and operating, and most electrochemists were somewhat skeptical in their attitude toward storage batteries of different type to the lead cell.

The output per unit weight of the lead storage battery varies with the design. Standard American cells usually give from nine to twelve watt-hours per pound of total element, while German cells for electric-vehicle use have an output of up to seventeen watt-hours per pound, though this latter figure is obtained by the use of exceedingly thin plates which are not considered advisable under the conditions which obtain in this country. The porosity and thickness of the plates both have an appreciable effect on the specific output. It is impossible to combine all advantages in one type of cell, and each manufacturer's practice must necessarily be in the nature of a compromise.

Doctor Sokal proceeded to tell of a method he is trying out of increasing the output for a given weight. Instead of using one more negative plate than positive, as is done at present, he recommended the use of one more positive plate than negative, as although the specific output of the negative electrode is greater than that of the positive, it is almost always the positive plate that fails first. He has constructed elements in this manner showing ten to fifteen per cent increase in specific output, but the practicability of his suggestion might be affected by further experiments.

The author then showed by detailed explanations that lack of electrolyte of proper concentration in the pores of the active material is the principal cause of the low output per unit weight of the lead cell. He told of his own experiments which he is conducting at present toward remedying this defect, by promoting the flow of the electrolyte through the pores by pressure or similar means. By forcing circulation through the walls of specially constructed shallow or bottle-shaped electrodes he had succeeded in increasing the specific output by from fifty to 100 per cent.

OPERATION AND CARE OF STORAGE BATTERIES.

Another paper on storage batteries was one entitled "Some Points in the Operation and Care of Vehicle Batteries," by H. M. Beck, of the Chicago office of the Electric Storage Battery Company, of Philadelphia. The author gave the following practical suggestions on the care of storage batteries: (1) The battery must be charged to a proper degree, not overcharged. (2) Short-circuits must be avoided. (3) The plates must be kept covered with electrolyte. (4) Only pure water must be used for replacing evaporation. With regard to charging: (1) On regular charges the rates must be kept as low as practicable and the supply promptly cut off. When in doubt cut off too soon rather than run too long. (2) Overcharges must be given at stated intervals and continued to a complete maximum. When in doubt run too long rather than cut off too soon.

Lack of "capacity" from batteries after washing is usually due to undercharging following the cleaning. It is a common mistake, and one to be deplored, that cells are frequently supplied with electrolyte instead of water to replace evaporation losses.

The author concluded by some excellent instructions on the methods to be employed in restoring a "low" battery to its proper condition. He said also that good results had been obtained with the mercury ampere-hour meter to show the amount that has been actually charged and also discharged in a vehicle's storage battery.

DISCUSSION ON STORAGE BATTERIES.

The two papers on storage batteries were discussed together. Ernest Lunn, of the Commonwealth Edison Company, Chicago, said, in commending Doctor Sokal's paper, that some of that gentleman's recommendations and predictions may be adopted in the near future. The mercury ampere-hour meter mentioned by Mr. Beck, he said, permitted the driver of an electric vehicle to ascertain the remaining battery charge, and that it enabled the private owner to keep a check on the amount of charge he is paying for at public garages.

A. Churchward, of the General Electric Company, New York, deprecated Doctor Sokal's criticism of the Edison battery, and said that his seven years' experience with one of these cells showed a discharge of considerably more than the eleven watt-hours per pound of element, given by Doctor Sokal. The new Edison battery, he said, gave over sixteen watt-hours per pound of element.

F. J. Newman, of the Woods Motor Vehicle Company, Chicago, remarked that want of proper axle alinement was a frequent cause of electric-vehicle troubles. The mercury ampere-hour meter, he said, was an old device and occurred in two types, one recording on discharge, and the other having the discharge travel at a faster rate than the charge and being compensated for. These meters are liable to be tampered with and are really unnecessary in commercial service, a hydrometer being quite sufficient for the purpose. The readings of the meter will be misleading any way, if the batteries are not in proper condition.

Wilton Bentley, of the Universal Electric Storage Battery Company, Chicago, suggested that ampere-hour meters might be locked to prevent tampering. He believed in their usefulness.

Scott Van Etten, Elkhart, Ind., gave as his opinion that the usefulness of the hydrometer test was interfered with by the formation of white sulphate of lead—among other sulphates—and that this gave a false specific gravity.

H. M. Beck pointed out that the specific-gravity test must show if the battery falls behind, and for this purpose the specific-gravity test was superior to the ampere-hour test.

J. F. Firestone, of the Columbus Buggy Company, Columbus, Ohio, said that shortage of water in the batteries was nine times out of ten the cause of the troubles encountered with electric vehicles.

Another trouble was lack of air in the tires.

F. J. Newman differed with Mr. Van Etten's remarks and explained the chemical action of the storage battery to substantiate his contention that there can be no false specific gravity. He said that the difference in sulphates was probably caused by difference in crystallization. He advised the use of a pilot cell.

Ernest Lunn said that in his six months' experience on fifteen vehicles with the ampere-hour meter he had had no troubles with it and no misleading results. The device was useful in that by its use it prevented vehicles from being stalled for lack of energy. The specific-gravity test, however, must not be overlooked.

Several other speakers gave their views on the subject.

Mr. Beck closed the discussion. He said that the ampere-hour meter must be considered as a supplementary device. The specific-gravity test gives practically the same information, but the meter is very convenient.

THE ELECTRIC CRADLE DYNAMOMETER.

A paper on "The Electric Cradle Dynamometer," by H. S. Baldwin, was read by Alexander Churchward in the unavoidable absence of the author. The electric cradle dynamometer was described more especially from the viewpoint of its adaptability in testing gasoline engines. The dynamometer is of the absorption type and an electric generator is used for loading the gasoline engine which is being tested. The energy is dissipated in a rheostat of suitable design placed at a convenient distance from the dynamometer so that the temperature rise of the latter is only moderate.

Will Pick Up Old Cable.

The cable-laying steamship Colonia, of the Telegraph Construction Maintenance Company, of London, which has completed laying 1,307 miles of cable for the Commercial Cable Company from St. Johns, N. F., to New York, is to try to pick up 900 miles of cable that is no longer in use.

According to Frank Petley, the engineer, the shore end of the cable weighs about sixteen tons to the mile, while the deep-sea cable, but an inch in diameter, weighs one-eighth as much. In the sweep of the circle made from St. Johns to New York to avoid shoals the cable lies for more than 150 miles in 3,000 fathoms, or 18,000 feet, of water.

Association of Edison Illuminating Companies—Dinner to Edison.

The annual convention of the Association of Edison Illuminating Companies will be held at Briarcliff, N. Y., August 31 to September 3, inclusive, under the presidency of W. W. Freeman, of Brooklyn, N. Y.

One of the distinguishing features of this, the thirtieth, convention will be a notable dinner given in honor of Mr. and Mrs. Thomas A. Edison on Thursday evening, September 2. On this occasion the association will entertain the guests of honor, who will meet the members of the association and guests composed mainly of those who were pioneers in the Edison electric-lighting industry in the early eighties.

The committee in charge of the arrangements for the Edison dinner consists of Samuel Insull, of Chicago, chairman; Charles L. Edgar, of Boston, and John W. Lieb, Jr., of New York.

The convention already promises to be one of the largest ever held by the association, and it is an interesting coincidence that it is both the thirtieth convention and the thirtieth anniversary of the commercial use of the Edison incandescent lamp of 1879.

Electricity for Mexican Mines.

The most important mining district in Mexico is soon to be electrified by a Canadian company, which will operate almost at the very border line of the United States. The organization is called the Mexican Northern Power Company, and has secured the rights to a perpetual concession granted by the government of Mexico for the development of the water-power on the Conchos River, in the state of Chihuahua, Northern Mexico, and its utilization, to generate electrical energy for the supply of cities and towns of that state and its mining districts. The district this company will serve is one of the largest and oldest of the mining districts of Mexico, and lies within fifty miles of the plant.

It is proposed to build all of the necessary dams and transmission lines for 25,000 horsepower, but to install initially machinery, hydraulic and electrical, for 15,000 horsepower only. The cost of construction for this is estimated at about $4,500,000 gold, and to increase to 25,000 horsepower will involve an additional outlay of $500,000. The selling price for the electrical energy is figured at $75 per annual horsepower on the peak load.

London's Subway System.

London is underrun by a network of subways or tubes. There is the Metropolitan line (the old Underground), seventy-one miles in length; the Metropolitan District line, twenty-eight miles in length; the Great Northern and Piccadilly line, nine-and-one-fourth miles in length, which is a double tunnel worked by electric motor power; the Baker Street and Waterloo line, nine-and-one-half miles in length, which was originally one of Whitaker Wright's enterprises; the Charing Cross, Euston and Hampstead line, about eight miles in length; the Central London line, six-and-one-half miles in length, which consists of two separate parallel tunnels worked by electric motor power on the multiple-unit system; the Waterloo and City line, about two miles in length; the Great Northern and City line, from Finsbury Park to Moorgate Street, about three-and-one-half miles in length; and the City and South London line, from Clapham Common to the north end of City Road, Islington, with an authorized mileage of twelve-and-one-half miles, something over half of which is in operation.

These lines cross and intersect at various points, making it possible by transfers to go almost anywhere underground. The total mileage—constructed, authorized and projected—is 145½ miles, and the total authorized capital of the nine existing companies is £61,553,996.

Refinancing of the New Orleans Railway and Light Company.

Directors of the New Orleans Railway and Light Company have settled the financing of their corporation on the following terms: They have sold to Bertron, Griscom & Jenks, of New York, and their Parisian associates, the first $5,000,000 of the new $50,000,000 bonds recently authorized by the stockholders. Under the terms of the agreement, Bertron, Griscom & Jenks are to take $5,000,000 of the new $50,000,000 bonds, $30,000,000 of which are to be placed in escrow to protect the company's underlying securities. They are to take these at the rate of $1,000,000 per year for three years, after buying in the first year $2,000,000, the proceeds of which will be used to retire the outstanding collateral trust notes of the company.

As a bonus for financing the proposition the New York and Parisian bankers are given about 26,000 of the company's preferred and common stock at forty and fifteen, respectively.

The New Telefunken System.

From reports just received, remarkable results are being obtained abroad with the Telefunken Company's new "singing" or "quenched-spark" system, recently described by Count Arco[1] in his paper before the Verband Deutscher Elektrotechniker (German Electrotechnical Society) at Cologne, Germany.

For instance, during some of the preliminary tests following upon the completion of the twenty-kilowatt station at Pola, on the Adriatic—which is one of three similar stations now building for the Austrian Government—it was found that the signals were so strong at both the Norddeich (on the North Sea coast) and Copenhagen stations that perfect coherer reception—*i. e.*, signals printed on tape—was possible at both stations. It was also possible to copy everything in Berlin with an ordinary portable set with a twenty-five-metre mast.

Even better results were obtained with an eight-kilowatt set installed on the Austrian battleship *Erzherzog Karl.* The tests with this set were made with the vessel at anchor at Pola, and in this case everything sent was copied at Kiel. Very interesting results showing the immunity from atmospheric interference with this system were also obtained with three vessels of the Black Sea fleet. These vessels were equipped with two-kilowatt sets, and while one vessel remained at anchor at Sebastopol the other two steamed out to sea. The transmitters of all three sets were adjusted for the same wave length, but for different tones, and although atmospheric interference, which is always troublesome on the Black Sea, was particularly strong, perfect communication, both ways, was maintained up to a distance of 600 kilometres.

It was also possible to receive two messages simultaneously from the moving vessels on the stationary one at Sebastopol and over the entire range and on one and the same receiver and detector, but with two differently adjusted telephone receivers. In this connection it is also interesting to note the remarkable fact that the signals from an old type fifteen-kilowatt station near Sebastopol, which was also used in this test, became absolutely unintelligible on board the moving vessels on account of atmospheric interference long before the extreme effective range of the new type two-kilowatt sets had been reached.

[1] See the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, May 29, 1909, p. 986.

St. Paul Company Backs Minneapolis Enterprise.

The Westinghouse interests of Pittsburg are, it is said, about to enter into the electric lighting field in Minneapolis. This is said to be in connection with the application of the Northern Heating and Electric Company, of St. Paul, for a Minneapolis franchise.

The Northern Heating and Electric Company, whose application for a Minneapolis franchise has been before the City Council, is backed financially, it is said, by the Lockharts, capitalists, of Pittsburg, who have many large investments, and who are its principal owners. This is confirmed by the St. Paul officers of the company.

Figures today show that the company has a stock issue of something more than $885,000, representing actual cash invested in the business in St. Paul. In the statement of December 31, 1908, the item of $483,626.88 appeared under the heading "obligations and unpaid bills." The company actually owes today, it is said, only $5,700, representing unpaid current monthly bills.

The Northern Heating and Electric Company has a twenty-five-year franchise. Its officers argue that this is a moderate term, considering that it would take a number of years to become fully equipped. They speak of plans that would mean the spending of much money and would give the company an investment in Minneapolis that within two or three years would equal or exceed that in St. Paul.

Telephones for Dispatching.

There are 250 miles of the Michigan Central equipped with telephones for train dispatching, and 200 miles more will be so equipped, making 1,000 miles of the New York Central system operated by telephone.

The Northern Pacific has installed telephone service on 470 miles and will install 250 more immediately.

The Norfolk & Western has arranged to equip its entire main line, 710 miles, with telephones.

These are some of the latest cases of this tendency in train dispatching.

New Penny for Telephone Slot.

It has been discovered in Washington, D. C., that the new Lincoln penny is five times as valuable, in one respect at least, as the old Indian-head cent. It will sometimes answer the place of a five-cent piece when making a telephone call.

Discuss Telephone Problems.

Eighty-five district managers and managers of the commercial department of the New England Telephone and Telegraph Company held their first annual convention at the Hotel Somerset, Boston, last week. L. P. Lanthier, of Boston, called the meeting to order.

The convention was held with the idea of giving the managers, scattered as they are through the four northern New England States, a chance to become better acquainted and of promoting a hearty esprit de corps. In this territory there are more than 320,000 subscribers, and the eighty-five managers at the meeting represented direct relations with the public in 261 exchanges.

Among the subjects given special attention were "Public Relations," "Municipal Relations," and "The Press." New ideas of operating and service were advanced and the company hopes that these ideas will prove of great benefit to the service and to aid toward furnishing the people of New England with the best telephone service in the world.

The commercial department is that branch of the company's organization which deals directly with the public.

A dinner at the Somerset concluded a busy two days' programme.

Giving the Poor Boy a Chance.

Hitherto, in England at any rate, the "plums" in the engineering profession have been open, with few exceptions, only to those privileged few who were able to afford the luxury of a premium apprenticeship or pupilage to some prominent engineer or in a large engineering establishment. Premiums have invariably ruled high, from hundreds to thousands of dollars, and the poor boy consequently had no chance to compete on anything like equal terms with the rich man's son.

It is gratifying then to be able to record the commendatory attitude of the authorities of the towns of Heston and Isleworth, suburbs of London, England, which places the matter of appointing apprentices on a strictly competitive basis. In future, in place of the departmental heads being allowed to take premium pupils, the vacancies as they occur will be put up for competition among those boys who at the elementary schools secured a scholarship, and have completed their course at the secondary school. This applies to the electricity undertaking and other departments of the Council.

Electrical Workers Petition for Safeguards.

The electric workers of South Bend, Ind., have filed a petition with the City Council asking for the betterment of electric construction and for the safer protection for the line men. The petitioners ask that all high-tension wires be placed on cross-arms for high and low voltage; that high-tension wires be placed on yellow cross-arms; primary and arc light wires on black cross-arms, and low-voltage wires, such as telephone, telegraph, police and fire alarm on red cross-arms.

When high and low voltage wires are on the same poles the petitioners ask that a clearance of six feet be made, and that all cross leads have a clearance of four feet with proper guards. High-voltage wires should be placed on the tops of the poles and no street-car line should carry more than a 1,000 voltage on their wires. In support of their petition the workers cite a number of fatal accidents where local electric workers had been electrocuted and nothing done to make conditions less hazardous. S.

7,500 Lights on One Sign.

Seven thousand five hundred electric lights on one sign is the record-breaking contribution which the firm of Colgate & Company, of New York, will make as its share of the Hudson-Fulton celebration. The Metropolitan Engineering Company has submitted a proposition for increasing the size of the big sign which the company now carries in Jersey City by the addition of a "life-size" electric-light reproduction of the "Half Moon."

At present the Colgate sign at the Pennsylvania ferry house, with its giant clock, is the largest device of the sort in the world, being 200 feet long by fifty feet high. The apparently moving pendulum effect is produced by a "flasher."

The electric "Half Moon" will be seventy-four feet long, with masts sixty feet high. The flags will be controlled by a flasher which will give them the effect of waving in the breezes; the same means will be employed to give the idea of dancing waves on which the old Dutch vessel rides. The present sign and the clock call for the constant use of 5,000 lights, and the addition of the "Half Moon" will bring into play 2,500 more. There will be two dates in large letters on the completed product—"1609" and "1806," the latter the year of the founding of the Colgate company.

The Röntgen-Ray Tube.

The Journal of the Röntgen Society contains an illustrated paper by J. H. Gardiner on the origin, history and development of the Röntgen-ray tube. The council of the society has recently got together a collection of tubes showing the development of the modern apparatus from the original Crookes tube used by Röntgen in 1896, and has presented it to the authorities of the South Kensington Museum. Several of the improvements illustrated by the collection are discussed by Mr. Gardiner, but the most important step taken recently appears to be the substitution of tantalum for platinum in the anti-cathode by Messrs. Siemens. The higher melting point of tantalum makes it possible to employ currents of thirty milliamperes through the tube. With a well-focused tube a current of this magnitude will melt the front surface of a tantalum anti-cathode one millimetre thick, and Mr. Gardiner advocates the use of a magnet to direct the cathode rays to a new portion of the surface.

Magnetic Detector for Slot Machines.

At the July 19 meeting of the Academy of Sciences at Paris, Messieurs Fodor and de Büty read a paper on "The Application of the Magnetic Properties of Metals to Automatic Coin Machines."

A permanent magnet is applied in a slot machine in such a manner as to permit the machine to operate only when a nickel coin is inserted. A disk of iron completely blocks the machine and prevents further use of the machine until the disk is removed. Disks or coins of other metals drop through without affecting the operating mechanism.

Twenty-third Street-Metropolitan Street Railway.

Judge Lacombe, in the United States Circuit Court, at New York, has denied the application for the Twenty-third Street Railway Company for permission to sue the Metropolitan Street Railway Company and its receivers, and the Metropolitan Trust Company, in the New York State Supreme Court, to recover $200,000 of the extended bonds, and $150,000 of its debenture bonds. In the memorandum Judge Lacombe says:

"I am satisfied that no sound objection can be maintained by any of the proposed defendants to this court's exercising plenary jurisdiction. Leave is granted to sue the receivers in this court."

Increase in Accidents on Indiana Electric Lines.

The Railroad Commission of Indiana has issued Bulletin No. 8, covering collisions and derailment of trains and casualties to persons during April, May and June, 1909. The total casualties on all electric interurban roads for years ending June 30, 1908, and June 30, 1909, are as follows:

	Deaths.		Injuries.	
	1908.	1909.	1908.	1909.
Passengers	5	13	168	213
Travelers on highways	23	14	30	54
Employes	5	6	28	43
Trespassers	12	19	3	15
Total	45	52	229	325

For the quarter ended June 30, 1909, compared with 1908, the total casualties on all interurbans were as follows:

	Fourth Quarter,	
	1908.	1909.
Deaths	11	20
Injured	64	98

The comment made is that the increase is not general over all the electric lines in the state, but is confined to a few lines.

Rock Island Orders Gasoline Cars.

The Rock Island Railway has tested the new gasoline car built by the General Electric Company, between Chicago and Bureau Junction, Ill., this week, and the officials were well pleased with the operation of the car, so much so that an order was wired to the Western Coach Manufacturing Company, of Schenectady, N. Y., for twenty-five of the cars. Some of the cars will be placed on the run between Peoria and Chillicothe, which for some time has been demanding a better service than is afforded by the regular passenger trains. The cars are fifty-five feet long and will seat forty-eight passengers. The car made a run between Joliet and Bureau Junction in two hours and ten minutes; while on the way out from Chicago the car made an average of forty-five miles an hour. V.

Live-Wire Thief Trap.

A new and successful use is being made of electricity in the discovery of wrongdoers in Indiana. Brice H. Reed, of Elkhart, connected a live wire in his boat house, and detected, without serious injury, the party who had been breaking into his boat house and carrying away fixtures and other property. And similarly the employes of a Goshen factory whose clothes had been repeatedly robbed of pocketbooks placed a live wire in a coat pocket containing a pocketbook and the suspected party was found writhing on the floor. S.

Illuminating Engineering Society's Convention.

The third annual convention of the Illuminating Engineering Society is announced to be held at the United Engineering Societies Building, 35 West Thirty-ninth Street, New York city, on September 27, 28 and 29 next.

The following tentative programme has been prepared:

Monday Afternoon, September 27, 2 p. m.—Address of welcome, T. Commerford Martin. Response, Walton Clark. President's address, W. H. Gartley. Reports: Committee on Nomenclature and Standards, Dr. A. C. Humphreys, chairman; Committee on Division of Membership, E. L. Elliott, chairman.

Monday Evening, 8 p. m.—Reception in the Assembly Rooms, followed by a musical programme in the auditorium.

Tuesday Morning, September 28.—Review of the historical parade in connection with the Hudson-Fulton celebration.

Tuesday Evening, 8 p. m.—Session for the presentation and discussion of papers.

Wednesday Morning, September 29, 10 a. m.—Session for the presentation and discussion of papers.

Wednesday Afternoon and Evening.—Arrangements for the entertainment of the lady guests, and for a general inspection of the illumination in the evening, will be announced later by the Entertainment Committee.

PAPERS.

The list of papers to be presented, which may be altered somewhat and which will probably be added to subsequently, is as follows: "Ethics of Illuminating Engineering," by E. L. Elliott; "Some Notes on Illuminating Engineering Practice in Europe," by H. Thurston Owens; "The Importance of Illuminometry in Practical Illuminating Engineering," by Norman Macbeth; "Efficiency of Lighting Installations," by A. L. Eustice; "Shades and Reflectors," by Dr. Louis Bell; "The Design of Reflectors," by A. J. Sweet; "Diffusing Mediums," by A. J. Marshall; "Absorption and Diffusion of Various Forms of Glass Surfaces," by Basset Jones, Jr.; "Factory and Mill Lighting," by L. B. Marks; "The Photometric Laboratory of the United Gas Improvement Company," by C. O. Bond; "The New Physical Laboratory of the National Electric Lamp Association," by Dr. E. P. Hyde; "The Problem of Heterochrome Photometry," by P. S. Millar; "Description of a Demonstration Lighting Installation," by W. C. Morris; "Discussion of the Efficiency of the Moore Light," by Messrs. Hyde, Woodwell, Sharp and Millar.

EXHIBITION.

The exhibition feature of the convention, which was so successfully introduced last year, will be extended in scope during the coming convention. The committee has secured the use of the building at 5 West Thirty-ninth Street, about midway between Fifth Avenue and the Illuminating Engineering Societies Building. This building was especially fitted up and occupied for a number of years by a prominent manufacturer of lighting fixtures, and is admirably adapted to the purpose.

A historical and educational exhibit will be arranged under the direct auspices of the Exhibition Committee. In addition to this there will be exhibits by the manufacturers of the various commercial types of electric and gas lamps, accessories and fixtures. The exhibition will be especially valuable as containing a number of the latest developments in the production and utilization of light, which have not been heretofore publicly exhibited in this country.

The building will be open to the public during the entire week, from 8:30 a. m. until 11 p. m.

London County Council Trolleys.

Of all electric-railway authorities in the United Kingdom, the best purchaser just now is the London County Council, which in respect of the current year's requirements has placed orders for 200 electric tramcars, the bodies to be of the Council's standard vestibule roof-covered pattern, with British Westinghouse electrical equipments, including trolley equipments and plows for running over conduit sections, and Westinghouse brakes. The total cost of the 200 cars will be $884,750; $1,590 per set is the cost of the equipments, plus $275 per car for the complete braking appliances. Fifty additional cars are also required by the Council, but it has been thought better, in regard to these, to make them to a particular design for safe working on steep gradients. First, one car is to be built at the Council's own car works at Leytonstone, and when it has been declared by the Board of Trade to be particularly suited for the class of service named, the other forty-nine will be made to the same design, etc. A. H. B.

The Copper Situation.

The report of the Copper Producers' Association for July, made public last week, shows a reduction of 32,261,454 pounds in the stocks of copper during July, in spite of a continuance of the heavy rate of production. Sales during the month, as indicated in the figures of deliveries to domestic buyers and for export, amounted to 150,539,057 pounds, a gain of 18,981,484 pounds over June. This is comparable with a decrease in that month from May's deliveries amounting to 148,505 pounds.

The stocks of copper now in the hands of the producers at all points in the United States total 122,596,607, only 239,341 more than were reported as on hand on January 1, when the Producers' Association's statistics were first compiled.

Production, too, which was increasing steadily during the first half of the year, remained about stationary during July. In that month there were produced 118,277,603 pounds, which compares with 118,356,146 turned out during May, the last preceding month of thirty-one days. The following table shows in detail the production, deliveries, and stock in each month this year, the figures being in pounds:

	Production.	Deliveries.	Stocks.
July	118,277,603	150,539,057	122,596,607
June	116,567,493	131,557,573	154,858,061
May	118,356,146	131,706,078	169,848,141
April	113,574,292	112,656,121	183,198,073
March	117,053,661	106,063,007	182,279,902
February	103,709,817	74,546,614	173,284,248
January	112,135,200	90,362,421	144,130,045

Liquid Fuel and Marine Practice.

In the course of an interesting paper by Arthur J. Maginnis on "Marine Engineering Progress," presented at the summer meeting of the (British) Institution of Mechanical Engineers last month, the author gave some interesting figures referring to the use of liquid fuel in marine boilers.

In the case of a vessel of the size of the Lusitania the number of firemen, he said, would be reduced from 312 to twenty-seven, a saving of no less than $35,000 would be effected in the cost of fuel, wages, etc., on each round voyage between Liverpool and New York, and increased accommodation both for passengers and freight would be afforded, all by the substitution of oil for coal in firing the boilers.

If the above estimates are approximately correct and there are no accompanying disadvantages it would appear that a great revolution in the design of large ocean-going steamers will be effected.

The Electrical Operation of Textile Factories.[1]

This paper is professedly in the main a review of the arguments, for and against the use of electrical power transmission in textile factories, which have appeared from time to time in various trade publications, engineering societies' proceedings, etc.

The claims in favor of electric driving are as follows: (1) Independence of relative locations of mill and engine houses. (2) Simplification of transmission apparatus, and consequent cost reduction and increased flexibility. (3) Less arbitrary grouping of machines. (4) Minimized chances of breakdowns causing stoppage of whole mill. (5) Sections of machinery may be stopped or run overtime without waste of power. (6) Reduction in maintenance and depreciation charges. (7) Reduction in capital cost per loom or per spindle of the whole factory when a given size is exceeded, partly consequent on the reduction in weight and cost of the buildings. (8) Records may be kept of work done in the various departments. (9) Greater steadiness of drive, thus permitting higher average speed and increased output.

This last is the most important claim of them all, and has been absolutely proved in many cases. Except where in a few special instances a variable speed is desired, an absolutely constant speed is most essential in textile machinery, where otherwise a difference in tension caused by a slight variation in speed will break the threads.

The speed of the driven machine should correspond with the speed of the prime mover. This is where the direct electric drive has the advantage over even the best rope transmission. With the latter it has been found that the speed of the machines closest to the driving point is steadier and higher than that of machines farther away. This entails a reduction in the quantity and also in the quality of the output. The author cited a case of two mills in Lancashire, under the same management, where the yarn from the electrically-driven mill of the two brought a price of about 2.5 per cent higher than that of the yarn from the mechanically-driven mill.

The increase in output of electrically-driven mills over mechanically-driven mills was estimated at about five per cent which the author showed gave an increased profit of about 0.35 per cent on the whole turnover, allowing for an increased cost in power (which personally he did not admit) and not taking into account the increase in quality of the finished product.

Admitting for the sake of argument the approximate correctness of these figures, the opponent of the electric drive would immediately advance the objection of increased capital cost caused by the installation of an electrical transmission system. From available records it may be said that taking a new spinning factory as a basis, and assuming that if electrically operated the structure would be brightened and modified to suit the altered conditions, then below 80,000 mill spindles the mechanical transmission system is the cheaper, between 80,000 and 100,000 the costs are about equal, and above 100,000 the electrical system is the cheaper. This implies the taking of the total cost of the finished factory, and would involve the use of a steam turbine or high-speed engine as the prime mover for the electrical transmission system. The steam consumption per indicated horsepower-hour would probably be slightly higher than if a slow-speed mill engine were used. The efficiency of the electrical transmission system would be about eighty-two to eighty-three per cent, or about the same as that of a well-designed modern mechanical transmission system.

In re-equipping an old factory it frequently happens that electric drive involves less capital expenditure than mechanical drive besides giving an increased efficiency. This is usually due to inconvenient arrangement of the existing buildings. Cases in the author's experience showed a reduction of twenty per cent in power consumption.

The author proceeded to show the advantages of the exhaust-steam turbine in the case of a fairly modern factory mechanically driven but electrically lighted. An additional load of about 200 horsepower to a load of 1,000 horsepower was required. The existing 1,000-horsepower, vertical, compound, condensing engine consumed about thirteen pounds of steam per indicated horsepower per hour. By combining this with an exhaust-steam turbine the main engine would generate (non-condensing, of course) about 850 indicated horsepower, and the turbine 500 horsepower, for a combined steam consumption of 10.5 pounds per indicated horsepower per hour. The increased available power over that required, involved either wholly or partially the electric driving of the factory. There were some special considerations involved, but these difficulties could be overcome without much trouble.

Regarding the advisability of taking power from an outside source, rather than generating it at the mill, it was pointed out that in Lancashire a factory of 1,500 indicated horsepower capacity can produce electrical energy at a cost of about 0.6 of a cent per kilowatt-hour, allowing for interest and depreciation. This is on the basis of a cost of $2.00 a ton for good slack coal (delivered) with a calorific value of 11,000 British thermal units per pound. It has been found generally practicable to induce fairly large companies to purchase power at about 0.8 of a cent per kilowatt-hour, the power being metered on the low-tension side of the mill switchboard before reaching the motors.

The main differences of opinion among engineers designing the lay-out of electrically-equipped mills arise over the questions of group or individual driving. The larger and the fewer the motors in a mill the smaller is the capital outlay, but at the same time the less the special advantages of electrical driving are felt. The more nearly the ideal of a motor to every machine can be approached the better the actual results, but the higher the capital outlay and generally the running cost. The author's personal feeling is in favor of the individual driving of ring spinning frames and the group driving of all other machines, but keeping the groups fairly small.

A point needing attention is the heating effect of the motors. In a ring-spinning room, for example, with a large number of small motors directly coupled to single machines, the total amount of heat given off from the motors may be sufficient to raise the room temperature considerably. It is now the best practice to build these motors with hollow frames and to bring cooling air from some external source round the frames, thus preventing the discharge of heat to the room. It should be added that in view of the great increase in electrical installations in the textile mills of this country the paper is particularly timely.

In conclusion, the author gave tables taken from practice showing the horsepower required by the different machines, and particulars as to speeds, loads, motor sizes required, etc.

[1] Abstract of a paper by Herbert W. Wilson, presented at the summer meeting of the Institution of Mechanical Engineers at Liverpool, England, July 27-30.

Trackless Trolleys in Europe.

Consul Walter C. Hamm, at Hull, England, sends a summary (*Daily Consular Report,* August 14, 1909) of a report on trackless-trolley cars employed on the Continent. The report was made by a committee consisting of two members of the City Council of Leeds, England, and the general manager of the tramway system of that city. They visited the Continent and inspected various systems of railless-trolley traction in order to advise as to the adaptability of such means of transit to the needs of English communities. The result of their observations is summarized as follows:

The three systems considered were the Mercedes-Stoll, which is in operation in various parts of Austria, and was seen in Vienna; the Filovia, used on six or seven routes in north Italy, and seen in Milan; and the Max Schiemann, which is employed in Germany, especially in the Rhine Valley.

The vehicles operated under each of these systems in general appearance do not differ greatly from the familiar single-deck motor omnibus, except that they have some means of collecting current, such as a "fishing rod" from the roof to the electric current supply, as in the case of ordinary electric cars worked from overhead cables. But while the ordinary electric car is able to let its used-up current return to earth through the metal wheels, the rubber-tired trackless tram has to let that current return by means of a second overhead cable running parallel with the supply cable. It appears that the principal difference among the various systems occurs in regard to the arrangement for keeping the two shoes on the two cables.

Mercedes-Stoll System.—The length of the route inspected in Vienna is about one-and-one-half miles, where the road—of a switchback character, having at one stretch of about 100 yards a gradient of one in ten—is macadamized. On this route there are two pairs of cables, one for going and one for returning cars, though elsewhere one pair is made to suffice, so that when two cars meet one has to stop and remove its connection with the wires until the other has passed. The vehicles carry twelve passengers seated. The entrance is at the driver's end, and he attends to all the duties of a conductor as well as driver.

The committee was particularly struck with the smoothness and comfort of riding, the spring base of the truck being very well arranged. The brakes are ample, and sprags are fitted to prevent running backward if the car is stopped on a hill. Satisfactory assurances were received as to the operation of the cars under the severest winter conditions, though it is noticed that on this particular route the cars have been running only since last October. The motors, which are each twenty horsepower, form the hubs of the back wheels, and the current is collected from the supply cable by means of a pair of wheels running on the top of the wire—a similar pair of wheels transferring the used current to the return. A weighted pendulum slung from a frame carrying these two pairs of wheels keeps them well pressed upon the wires, and the current is conveyed to the motors, not by a "fishing rod," but by a pair of cables which allow the car to pass to any part of the road in the avoidance of other traffic. The empty car weighs two-and-one-half tons.

The cost of the chassis of the Mercedes-Stoll is about $2,750, without body. The cost of the overhead construction is about $8,500 per mile.

Filovia System.—On the Filovia system in north Italy, the cars will take thirty passengers. A framework, carrying two pairs of wheels, one pair in contact with each overhead cable, is employed to maintain the circuit. It is very similar to that used in the Mercedes-Stoll system, except that it is pressed by a "fishing rod" or "boom" against the under sides of the cables. There are two direct-current motors of ten to twelve horsepower each.

The route inspected, owned by a private company, is four-and-one-half miles long, and the fare charged is eight cents. The committee found the vehiciles well able to reverse, turn around, and maneuver without the trolley being removed, and to take heavy gradients over bad and muddy roads without difficulty, vibration, or noise. The practicability of this type of railless traction considerably impressed the committee. The cost of overhead construction is estimated at only $3,756 per mile, but only wooden poles were used. They were, however, found to be quite serviceable.

Max-Schiemann System.—The Max-Schiemann system was seen working at Mulhausen. Here the contact with the pair of cables is maintained by means of a "fishing rod," carrying at its extremity a pair of sliding shoes. The overhead construction is similar to that of the systems previously described. The vehicle carries about fifteen passengers seated, and only the front wheels have rubber tires, so that there is considerable vibration and noise. The single motor drives onto the front axle, so that the steering is comparatively heavy. The design of this type, however, is stated to be undergoing radical modification. The weight of the present empty car is 6,330 pounds.

It is stated concerning all of the three systems that very few hitches have been reported, and owing to the comparative lightness of the vehicle the surface of the road suffers less than in the case of a service of cars carrying their own patrol or other engines.

The committee was much impressed with the practicability of each of the various schemes, and considers that by avoiding the heavy expenditure required in the installation of ordinary tramway traction this method of conveyance offers considerable possibilities as general feeders in suburban and interurban districts to tramway systems, and is quite capable of supplying a sufficient service for thinly populated districts on a reasonably economic basis.

An Important Meeting in the Northwest.

The Seattle section of the American Institute of Electrical Engineers and the Northwest Electric Light and Power Association will hold a joint meeting at Seattle, Wash., at the Alaska-Yukon-Pacific Exposition on September 7, 8 and 9. On the first day four papers will be read on the subjects of electric power transmission, telephone practice in the Northwest, electrical illumination and relative merits of the different types of incandescent lamps. On the second day there will be executive meetings of the Light and Power Association. The programme for the third day has not been decided upon, but it is expected that it will be made up largely of entertainment features.

The Seattle section of the Institute is one of the most progressive branches of the national organization. Regular meetings are held and the members are all alive to the possibility of assisting themselves to the parent organization by active, earnest work. The section is making a very creditable exhibition at the Exposition, and its booth is headquarters for visiting engineers engaged in all branches of electricity and allied engineering departments.

Examination for Signal Service Electrical Assistant.

The United States Civil Service Commission announces an examination on September 29, 1909, to secure eligibles from which to make certification to fill two or more vacancies in the position of electrical assistant in the Signal Service at Large, War Department, at $1,080 per annum. The examination will consist of the subjects mentioned below, weighted as indicated:

Subjects.	Weights.
1. Practical questions in electrical science	20
2. Practical questions in construction and installation of electrical instruments.	30
3. Training and experience.....	50
Total	100

Applicants should be thoroughly familiar with the practical side of electricity as applied to telegraph, telephone and cable engineering, and also with the methods of testing and installing electrical instruments used in fire control, such as storage batteries, motor generators, power and telephone switchboards, wireless telegraph apparatus, telegraphs, electric clocks, telephones, etc.

In accordance with a recent act of Congress an applicant for this examination will be required to be examined in the state or territory in which he resides and to show in his application that he has been actually domiciled in such state or territory for at least one year previous to the examination.

This examination is open to all citizens of the United States who comply with the requirements.

Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners at the principal cities for application Form 1312. No application will be accepted unless properly executed, including medical certificate, and filed with the commission at Washington prior to the hour of closing business on September 18, 1909.

Asks $20,000,000 Increase.

At a public hearing in the Engineering Society Building, 29 West Thirty-ninth Street, New York city, before the up-State Public Service Commission, the New York, Westchester, Manhattan & Boston Railway Company asked permission to make an increase of $20,000,000 in its capital stock. The company's present capital is $4,000,000.

The corporation, which is controlled by the New York, New Haven & Hartford Railroad Company interests, recently acquired all the rights, title, and interest to the New York and Port Chester Railroad, and it asked for permission to consolidate the two properties, the same to be operated under the name of the New York, Westchester & Boston Company.

Electrolytic Disinfecting; Results of the Poplar (London, Eng.) Plant.

The electrolytic disinfectant plant which was put down by the Medical Officer of Health for Poplar (London, Eng.), Dr. F. W. Alexander, has continued to give satisfaction during the third year of its working. During these three years the Public Health Department has used no other disinfectant, and Doctor Alexander says that during the past year the saving to the borough has been $4,000. Since its introduction the plant has paid for itself and for the construction of the depot, has saved more than $6,000 to the borough, and the health of the inhabitants has improved. The plant, which is producing 185 gallons of fluid in eight hours, at an average strength of 4.5 to 5.0 grammes of chlorine per litre, has been greatly improved since it was first put down. During the past year it produced and distributed to the various depots 28,280 gallons of the electrolytic fluid, the cost of the materials being $280. This figure includes: chloride of magnesium, $52; six tons of salt, $49; caustic soda, $29; 4,543 units of electricity, at three cents per unit, $142, and water, $8. Tests as to the stability of the fluid showed very satisfactory results for eighteen months or two years after it was made. As passengers are landed at Poplar by vessel from cholera-infected ports, samples of the fluid have been examined and reported upon by Doctor Klein, the eminent bacteriologist to the Local Government Board, and he states that one ounce of the electrolytic fluid to 150 ounces of water will kill the cholera germ in two-and-one-half minutes, and in the same proportion will kill the typhoid fever germ.

Excavate By Electricity.

The Utica Gas and Electric Company, of Utica, N. Y., has closed a contract with the Stanley-Morrissey Company, which has the contract for building the barge canal from the Oneida-Herkimer County line to the Oriskany road, a distance of about eight miles, to furnish electricity for the operation of two large excavators which, it is expected, will be in operation in about six weeks. The construction company has also contracted for electricity for lighting purposes, and it is intended to run the excavators night and day, three separate shifts of men being required, each working eight hours. The transmission lines run close to the right-of-way, making the power very convenient.

Vacuum Cleaners on Trains.

The Great Northern Railway has introduced another innovation on its transcontinental train between St. Paul and the Pacific Coast. Vacuum cleaning machines are now used to keep the cars spick and span. The time-honored broom has been relegated to a dark corner of the porter's locker, and its functions hereafter will be performed by portable vacuum cleaners, in charge of a skilled operator. The machine is mounted on wheels and is taken from car to car. There are special attachments for taking the dust out of upholstery, curtains and draperies, as well as from the carpets. The vacuum cleaner is now a part of the train equipment, and a uniformed operator has been added to the train crew; his only duties being to keep the cars neat and clean.

Side-Door Subway Trains.

In accordance with the orders of the New York Public Service Commission, the Interborough Rapid Transit Company, New York city, now has in operation six trains consisting of forty-eight side-door cars. The train of end side-door cars, as recommended by B. J. Arnold, is now in the shop and will be converted into the center-door type. Transformation of that portion of the rolling stock recommended in the Commission's order will be pushed as fast as possible, and it is expected that it will all be in operation within the time allowed in the order.

New York Central Extends Its Electrification.

Steadily and surely the electrical zone of the New York Central & Hudson River Railroad is reaching out toward Fishkill Landing, to which it must inevitably be extended soon.

So steadily is the extension of the zone going on that to reach these villages is now but a step. Croton, about twenty-five miles south, already is in the zone, and Peekskill, Cold Spring, and Fishkill Landing will be included when the next step northward is taken.

Last week the big power plant at Glenwood, near Peekskill, was put in operation. This plant gives the New York Central a power house which will supply power sufficient to run the cars from New York to Croton-on-Hudson. A like plant is to be erected either at Fishkill Landing or Poughkeepsie. Grade crossings are to be abolished within the zone.

BOOK REVIEW.

"Elementary Manual of Radio Telegraphy and Radio Telephony," by Prof. J. A. Fleming. London, Eng.: Longmans, Green & Company. Cloth, 340 pages, illustrated. Supplied by the Electrical Review and Western Electrician for $2.

This manual is intended for those with an elementary knowledge of electricity and magnetism, who are not prepared to follow the more pretentious treatises on the subject, for instance, "The Principles of Electric-Wave Telegraphy," by the same author. The treatment is mildly technical and free from advanced mathematics, many analogies being given to aid the explanation of oscillatory electric current phenomena.

The first three chapters discuss "skin effect" and other changes in wire constants due to high-frequency currents. The properties and choice of dielectrics are carefully considered for these frequencies.

After discussing the physics of the differential "frequency equation" of an oscillatory circuit, practical rules for choosing wireless apparatus are given. Too much space is devoted to interrupters, as modern practice tends to small transformers. Coupling between two circuits is treated mathematically, and the method is given of producing phase differences in two transmitted waves for securing partial secrecy.

Modern apparatus, such as the high-frequency arc and generator, is treated rather loosely, the arc especially receiving by no means as good a presentation as could be expected. No discussion is given of the criteria of frequency, stability, type of arc, whether "pure" or "impure" Duddell phenomena are involved, etc., all of which are elementary factors, and can be found in Barkhausen's memoir. A good comparison of criteria for achieving sharp resonance with persistent oscillation is given, however.

In Chapter IV the author persistently asserts that the electric and magnetic forces in a plane wave are in quadrature, whereas they are in phase. Too great authority has been attributed to his powers of mathematical treatment to allow such a palpable error to pass unnoticed. By a double error he derives the correct circuital equations, and then gives their particular instead of their general solution.

His solution is of the form $E = A \sin \phi$

$H = B \cos \phi$

Whereas the correct general solution is

$E = A \sin \phi + B \cos \phi$.

$H = C (A \sin \phi + B \cos \phi)$, which are in the same phase, and only differ by a constant.

His model on page 126, of an electric wave, is, of course, incorrect.

In treating the radiating and receiving circuits the author uses the questionable assumption, discarded for five years in the best American practice, that a linear oscillator with variable current along its axis is equivalent to a Hertz oscillator with uniform axial current. This error renders the "resistance equivalent of radiation" as given by the author incorrect—a single wire antenna vibrating at its fundamental has a resistance of forty ohms instead of sixty-four ohms. The treatment of the magnetic or small loop oscillator is not reduced to a practical basis, *i. e.*, while the closed-circuit oscillator radiates, other things being equal, as the square of the frequency and the open-circuit or electric oscillator as the square of the frequency, in the latter case, other things are not equal, as the current is a function of the frequency, and with a given voltage it radiates as the fourth power of the frequency, and not as the square.

Proper forms of verticals and "earthing" are taken up and a discussion of the directive antenna is given based on the analysis of a loop into a composite system of the Hertz oscillators—a view challenged as erroneous by both German and American physicists. A theory of long-distance transmission is given, which tends to support Nikola Tesla's early ideas of "world telegraphy." The author on page 166 is in error when he states that a Stone direction finder cannot use waves of more than 1,000 feet successfully. As a matter of fact, 600-metre waves permit a warship's bearing, seventy-five miles away, to be known quickly to within five degrees. The Bellini and Tosi direction finder is carefully described, however, and discussed in an interesting manner.

In treating the subject of oscillation detectors. Fleming discusses their underlying principles shortly but systematically. The chapter is marred, however, by the author's habitual and unnecessary dragging in of the Fleming-De Forest controversy over the invention of the "audion" detector. Waiving the merits of the case, expert handling has shown that it is by no means a pure rectifier and therefore not a valve. The author seems studiously to have ignored its distinctive features—as it is certainly more sensitive than any oscillation gas valve. Another detector recently patented by L. H. Walter, which embodies a tantalum-mercury contact, has been used at various times in two laboratories in this country, in fact, as early as 1904.

The remainder of the book concerns itself with the design and operation of large stations and the elimination of natural and artificial interference. German methods with arc stations, and Marconi's long-distance work with the spark, are described. Radiotelegraphic measurements are concisely classified, and although many difficulties are pointed out, the treatment could well be more exhaustive—"damping" especially needs more discussion.

The final chapter, on radiotelephony, should have been called an appendix; as, although the treatment is clear, it is not extensive enough to justify the latter half of the book's title. Professor Fleming might well refer to the work of De Forest along arc telegraphy and telephony, in view of the latter's reputation and achievements during the past year in Europe and America.

On the whole, the manual is well worthy of a place in any electrical engineer's library who can overlook faults due to the personal equation in the application of theory to fact. Its defects are, with two exceptions noted above, those inevitable in a work collated from many sources, and are compensated by general excellence of arrangement and clearness of presentation. The author's progress toward a broader view of both American theory and practice will doubtless prove instrumental in removing the slight defects of the present volume in future editions. Freedom from typographical errors and an excellent binding render the price ($2.00) a remarkably reasonable one in contrast to that of more pretentious works on the subject.

O. C. Roos.

Trackless Trolleys in New York?

The Trackless Trolley Company, of New York city, with a capital of $150,000, has been incorporated at Albany, N. Y. The directors are Charles E. Barrett, of New York city, and A. Livingston Norman and Sadie E. Wiener, of Brooklyn.

Trackless trolleys are being established in one or two English cities and have been in operation for some time in certain European cities. In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of April 10, 1909, appeared an article giving the results of trackless trolley omnibus service in Vienna and other cities.

QUESTIONS AND ANSWERS.

MEASUREMENT OF THREE-PHASE POWER.—Kindly inform me what is the best and simplest method of determining the horsepower-load on three-phase motors? Can the voltmeter and ammeter be used for this purpose?—W. A. T., St. Charles, Mo.

If by horsepower-load is meant the mechanical output of the motor, the proper method for determining this is by means of a Prony brake or other similar device for measuring mechanical power. If the electrical input to the motor is meant, this is best determined by means of either the single, or better yet, the two-wattmeter method. A voltmeter and ammeter cannot be used to determine alternating-current power as they can for direct-current power. In the latter case the product of the volts and amperes gives the power in watts, but in alternating currents another factor enters into the calculation. This is the cosine of the angle or lead or lag; it is usually termed the power-factor. If a voltmeter and ammeter were used it would also be necessary to use a power-factor indicator to determine this other element. Moreover, the readings would have to be taken on each phase, since it is never certain whether the circuit is perfectly balanced. By using a wattmeter the power is determined from one instrument. When the single wattmeter method is used, the current coil of the instrument is placed in one phase of the circuit and the pressure circuit is connected first between this phase and one of the other two, and then between the same phase and the one remaining. The sum of the two readings obtained in this manner is the true power of the circuit.

ELECTRIC LAMPS FOR PRINTING PICTURES.—What is the best electric light to print pictures by? We have used carbon 110-volt arc lamps, but they seem to flicker too much. Recently you described the Küch quartz lamp. Who manufactures this lamp, and is it for sale in this country?—H. S. D., Plattsmouth, Neb.

For printing photographs, blue-prints, etc., both arc lamps and mercury-vapor lamps have been extensively used. There is some difference of opinion on the part of those who have had experience with each type of lamp as to which gives best results. The mercury-vapor lamp is a more efficient lamp and is very rich in actinic or chemical rays, which seem to adapt it excellently for this purpose. However, it is claimed by some that, because the light does not come from so concentrated a source, it does not give such sharp contrasts nor so well-defined a print. The Küch quartz lamp is manufactured by the Quartzlampen-Gesellschaft, Pankow, Germany. We have not been able to determine whether this company has any agency in this country.

ADVANTAGES OF ENCLOSED FUSES.—Why are enclosed fuses generally required in place of the less expensive and simpler open fuses? Are not open fuses equally reliable?—J. S., Eau Claire, Wis.

The enclosed fuse is a much more reliable and safe device than the open fuse. It is more expensive, but its action is more dependable and avoids fire hazard due to the use of open fuses. When an open fuse "blows" the molten metal usually flies in all directions and is apt to cause damage. Moreover, where open fuses are used it has been found to be the common practice to replace them when blown by anything in the shape of a wire conductor that is available regardless of proper carrying capacity and melting point. The enclosed fuse prevents the splashing of the molten metal since it retains all these particles within the cartridge. Usually the terminals are so spaced that none other than the right type of fuse can be used.

SKIN EFFECT.—What is meant by skin effect in electric circuits?—V. P. B., Memphis, Tenn.

It has been found that the effective resistance of a conductor when carrying alternating current is somewhat higher than when it is carrying direct current. When the frequency is very high or the conductor of large diameter this difference becomes quite marked. It is in general due to the fact that with high-frequency alternating current the central portion of the conductor does not carry its proportionate share of the current, and that the outer layers form the effective conductor. This is therefore called the "skin" effect. The exact reason for this phenomenon seems to be because each element of the conductor is surrounded by its own magnetic field, and the exterior portions of the conductor are cut by the circular magnetic lines due to the interior elements. This produces a local electromotive-force which tends to send a current in the exterior of the wire along with the main current and a return current through the interior opposing the main current. Therefore the central portion of the conductor is apt to carry very little current at very high frequencies. It has been proposed for this reason to use tubular conductors for high-frequency purposes.

FREQUENCY CHANGERS.—We have a twenty-five cycle supply and wish to use upon it arc lamps which we understand require sixty-cycle current. Is there some simple way for changing the twenty-five-cycle to the sixty-cycle current?—F. T., Lockport, N. Y.

For changing the frequency of an alternating current it is necessary to use a set of rotating machines. The most common type of freqency changer is a motor-generator set, the motor of which is a synchronous motor which has mounted upon its shaft a generator developing alternating current of the proper frequency. The only connection between the machines is the mechanical connection of the shaft. The ratio of the number of poles of the generator and motor must be the same as the ratio of the two frequencies. Another type of frequency changer is used somewhat in England. It is known as the induction frequency changer. It has an induction motor with a coil-wound rotor. Mounted on the same shaft is a machine which resembles a rotary converter except that it receives its electrical supply from the rotor of the induction motor.

THE USE OF SQUIRREL-CAGE MOTORS IN MINING.—What type of electric motor is best suited for mining purposes? Has the induction motor any advantages over the direct-current series motor?—Y. A., Kobe, Japan.

For electric mining purposes it is necessary to use a type of electric motor as free from hazard and as rugged in construction as possible. The direct-current motor has excellent operating characteristics, but when used for such hard service as it is subject to in mining, the commutator and brushes are not apt to receive the proper attention, therefore sparking of the brushes is liable to be frequent. In coal mines particularly sparking must be absolutely avoided on account of the danger of igniting inflammable gases. The induction motor, particularly of the squirrel-cage type, requires no sliding electrical contacts of any kind. The connections to it are made permanent and the rotor is self-contained and is not connected with the circuit in any manner. Therefore this machine meets the requirement of freedom from sparking. Incidentally it is a very rugged machine and is capable of standing the most severe service. Induction motors with auxiliary resistance for the rotor circuit require a commutator.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

MANUFACTURERS' LIGHT AND HEAT COMPANY.

The semi-annual report of the Manufacturers' Light and Heat Company and affiliated companies, of Pittsburgh, Pa., for the six months ended June 30 shows the gross earnings were $2,802,699.33, and the operating expenses were $671,-882.83. During the period the company purchased $215,363.18 of gas from other producers. Changing construction cost the company $11,260.43. Taxes totaled $44,361.18. This makes the total operating expenses and taxes $942,867.62, leaving net earnings from operations $1,859,831.71. Deductions from net earnings include interest and discount and accrued interest and tax on bonds, $343,021.91; drilling wells, $149,519.44, leaving a surplus of $1,367,290.36. The net decrease in liabilities is $1,220,798.26.

The following balance sheet of June 30, 1909, compared with the balance sheet of December 31, 1908, shows the following changes in the assets and liabilities of the company:

LIABILITIES.

Bonds paid and canceled	$789,500.00	
Decrease in bills payable	502,557.10	
Decrease in accrued interest	21,987.34	
Total decrease in liabilities		$1,314,044.44
Increase in accts. payable	$ 78,165.29	
Increase in security deposits	2,599.90	
Increase in accrued tax on bonds	12,480.99	
Total increase in liabilities		93,246.18
Net increase in liabilities		$1,220,798.26

ASSETS.

Improvements, betterments, extensions, etc.	$208,344.47	
Wells, new material	78,654.24	
Increase in investment accounts		$ 286,998.71
Increase in bills receivable		9,217.56
Total increase in assets		$ 296,216.27
Decrease in cash	$ 87,657.97	
Decrease in accounts receivable	62,066.20	
Total decrease in assets		$149,724.17
Net increase in assets		$ 146,492.10
Surplus		$1,367,290.36

The consolidated balance sheet shows as follows:

ASSETS.

Property account	$37,193,511.26
Treasury stock	628,600.00
Cash	246,022.05
Accounts receivable	465,670.62
Bills receivable	33,625.85
Total	$38,567,429.78

LIABILITIES.

Capital stock	$21,500,000.00
Bonds less cash in sinking funds	5,855,500.00
Bills payable	2,921,288.57
Accounts payable	207,059.11
Security deposits	87,722.01
Accrued interest on bonds	72,585.00
Accrued tax on bonds	101,835.32
Surplus December 31, 1908	6,454,149.41
Surplus 1909, to date	1,367,290.36
Total	$38,567,429.78

AMERICAN LIGHT AND TRACTION.

The American Light and Traction Company has issued its report for the six months ended June 30, 1909, showing a balance after all charges and dividends of $317,860, against $203,430 the previous year and $167,259 for the corresponding period in 1907.

LONDON UNDERGROUND.

The Underground Electric Railways, of London, report earnings for the week ended July 31, and for thirty weeks ended July 31, 1909, compared as follows:

	1909.	1908.
Bakerloo	£ 3,125	£ 2,720
Piccadilly	5,180	4,815
Hampstead	3,670	3,200
District	9,753	8,841
Tramways	6,393	8,382
Total	£ 28,121	£ 27,958
Thirty weeks:		
Bakerloo	£ 99,520	£ 90,980
Piccadilly	172,380	161,730
Hampstead	116,610	97,690
District	299,661	270,398
Tramways	178,540	196,799
Total (30 weeks)	£866,711	£817,597

NORTHERN TEXAS ELECTRIC.

The Northern Texas Electric Company, which owns the capital stock of the Northern Texas Traction Company, of Fort Worth, Tex., has issued a report for the year ended April 30, 1909, which compares as follows:

	1909.	1908.
Gross earnings	$1,142,510	$1,080,577
Operating expenses	668,124	630,052
Net earnings	$474,386	$450,525
Deductions:		
Interest and taxes	$200,449	$189,541
Preferred dividends	150,000	149,700
Total deductions	$350,449	$339,241
Surplus	123,937	111,284

BELL TELEPHONE OF CANADA.

The Bell Telephone Company, of Canada, has issued its annual report for the year ended December 31, 1908, which compares as follows:

	1908.	1907.
Gross earnings	$4,580,606	$4,829,657
Operating expenses, legal insurance, bond interest and miscellaneous	3,156,332	3,785,859
Net earnings	$1,424,274	$1,043,798
Dividends	1,000,000	871,018
Surplus for year	$ 424,274	$ 172,779
Previous surplus	66,225	61,037
Total sprplus	$ 490,499	$ 233,816
Deductions:		
Charged off building	$ 90,654	.....
Insurance reserve	115,517	1,631
Accident reserve	53,670	3,509
Contingent account	150,000	162,451
Total deductions	$409,842	$167,592
Surplus, December 31	80,657	66,225

Western Electric Reports Better Business Than Ever.

Preliminary returns of the Western Electric for July show that the company's business for that month ran approximately forty-six per cent ahead of July, 1908. The eight months' returns indicate a gross business for the year of about $47,000,000, but it is expected that the improvement in industrial conditions, which is now setting in, will enable the company to show nearer $50,000,000 in round figures. For the year ending November 30 last, gross sales of the Western Electric totaled $33,000,000. In 1907 the total was $52,000,000 and $69,-000,000 in 1906, the last-named figure being the high record for the company. So it is clear that 1908-09 will show close to the Western Electric's second best record.

July is ordinarily a slightly better month, it being the time of the year when the purchasing for fall requirements begin. In respect to electric-lighting supplies and electrical machinery, last month was the largest in the Western Electric's history.

Of late there has been considerable activity in the foreign departments. The recent order by the Chinese government for an experimental telephone system for the city of Pekin is important rather as an indication of the rapidly changing attitude of China, than for the size of the contract, which amounted to about $150,-000. This news is particularly interesting to Wall Street in view of the efforts of American capital in late years to open up China to modern ideas and methods. The room which exists for expansion may be gathered from the fact that the population of China is five times greater than the population of the United States.

B. F. Sturtevant Company Reorganized.

The B. F. Sturtevant Company, having formerly a capital of $500,000, has been reorganized and recapitalized. The new corporation is organized under Massachusetts laws with $1,250,000 six per cent cumulative preferred stock and $1,-250,000 of common stock, and the stock has all been taken by a few of the large owners. John Carr is president, Eugene N. Foss is treasurer, and E. B. Freeman has been elected general manager.

The increased capitalization represents capital expenditures during the past year, largely in the erection of a new plant in Hyde Park, which cost over $1,500,000. The B. F. Sturtevant Company has been doing a business of about $3,000,000 a year.

Firmer Crude Rubber Market.

During the latter part of the week the crude rubber market has ruled firm, due to speculation in London. Manufacturers are still buying only moderately to meet their urgent requirements. Quotations are: Up-river Para, $1.91; coarse, $1.15; islands, fine, $1.79@$1.80; coarse, $0.78.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

AN ALTERNATING-CURRENT PRIMARY CELL.

A curious galvanic cell giving alternating currents for several hours is described by W. Kistiakowsky in the *Zeitschrift für Elektro-Chemie,* of May 1, 1909. The communication comes from the electrochemical laboratory of the St. Petersburg Polytechnic. The cell consists merely of two iron electrodes, preferably of different surface areas, made of pure iron, such as can be obtained from Kahlbaum, in Berlin, and of a mixture of sulphuric acid and potassium bichromate, which is used in primary cells. The proportions of these latter chemicals should be a solution of potassium bichromate, saturated at eighteen degrees centigrade, and a double normal sulphuric acid, mixed in equal volumes. The iron is applied in sheets of 0.2 millimetre thickness up to seven centimetres in width; they are dipped into the electrolyte to a depth of three or four centimetres. When the circuit is closed by an aperiodic voltmeter, and the scale is so arranged that zero is in the middle, the needle will be seen to oscillate between + 0.4 volt and — 0.4 volt in a peculiar fashion. The needle creeps up on the positive side, slowly at first, then more rapidly; it stops for a moment at + 0.4 volt, and suddenly swings back to zero. After an interval of five or ten seconds the needle moves over to the negative side in the same manner, stopping at — 0.4 volt and returning. Another interval of five or ten seconds follows, and the play is repeated. These oscillations of the electromotive-force may continue for hours. Sometimes the one plate becomes passive, and the phenomena then become pulsating; the current oscillations are confined to the one side, positive or negative, as if only one of the electrodes were active. When no current fluctuations are observed at all, they can be started by cleaning the electrodes (with the aid of emery paper) or by touching them in the electrolyte with metallic magnesium. The phenomenon recalls the oscillatory character of the solution of chromium in certain solvents which W. Ostwald observed some years ago. The electrodes of the cell may also be made of chromium, but the oscillations are less marked than with iron electrodes, with which currents of 0.15 ampere can be obtained. The communication of Kistiakowsky is preliminary. It would be interesting to hear more about the pulsating currents resulting when one of the electrodes is in the passive state; the phenomena of passivity are still obscure, and might further be studied in this way.—*Abstracted from Engineering (London), July 30.*

STANDARDIZATION OF CONDENSERS.

The precise determination of capacities is frequently of considerable importance in the investigation and arrangement of telephone and telegraph lines, and especially in telegraphy without wires. Devaux-Charbonnel has obtained very exact results by means of a method, the principle of which is well known, but which does not seem to have received the appreciation it deserves. The method is described by him in a note to the French Academy of Science. If a capacity C charged by a battery E is discharged n times per second through a galvanometer, one may ascertain the passage of a current $I = nCE$. The same current may be reproduced by means of the same battery and a resistance R: $I = E/R$. From this the value of the capacity may be immediately deduced: $C = 1/nRE$. An electric tuning fork was employed for producing the successive discharges. A sheet of platinum attached to one of the branches of the fork oscillates between two contacts, and at each oscillation charges the condenser and discharges it through the galvanometer. At the same time a stylo inscribes on a cylinder covered with lampblack the vibrations of the tuning fork and also those of an electric seconds pendulum. A remarkable precision may be attained with this arrangement without difficulty. A fraction of one-thousandth of a second may be observed on the cylinder; the resistance can also be measured with great exactness and the capacity is, therefore, easily determined within one-thousandth of its value, which is more than sufficient for practical purposes. In working with a standard mica condenser it was observed that, contrary to accepted opinions, its capacity varies slightly with the frequency. An air condenser maintained the same capacity, no matter what the frequency. The exact knowledge of capacities also makes it possible to verify the graduations of variable self-inductions by balancing the self-induction by a condenser shunted through a resistance in a bridge arrangement with telephone.—*Translated and abstracted from L'Industrie Electrique (Paris), July 25.*

IMPROVEMENTS IN ELECTROPLATING.

Wire, band or tape is usually provided with galvanic coatings by passing it successively through the cleaning arrangement, the galvanic bath and the after-treatment apparatuses. The wire is unrolled from one drum, galvanized and wound on another. In consequence of the great length of the wire in the bath, comparatively heavy currents have to be employed, and the sagging or breaking of the wire means danger of short-circuit by contact with the anodes. The high current intensity itself has an injurious effect on the structure of the wire, and it also suffers if it is made to change its direction several times in the bath by bending it over rollers. F. A. Hermann, of Leipsic, has overcome these evils by passing the wire through a rake-like arrangement or a crating of insulating material which is not attacked by the electrolyte employed. Furthermore, the guide-rollers for the wire are movably arranged so that they are pressed down by the wire, when it is tight, but which raise when it becomes slack or breaks and lift it from the current-conducting rollers. Another method of electroplating wire, chains and the like devised by Dr. A. Barth, of Frankfort-on-the-Main, aims at preventing the repeated bending of the wire during the treatment. In this process the wire is unwound from a drum, passed in a perfectly straight line through the cleaning and galvanizing baths as well as through the washing, drying and polishing arrangements and then wound on a second drum. This is accomplished by moving the wire at a slight angle to a horizontal line so that it enters the bath from the top and leaves it

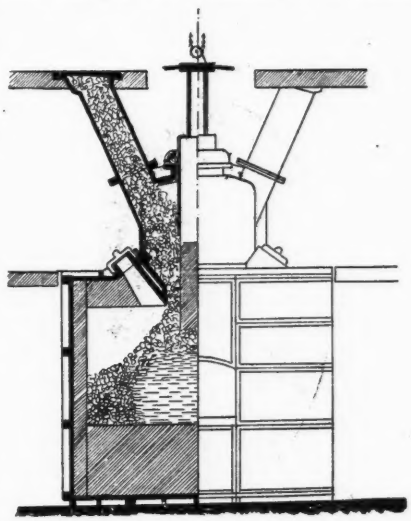
through an opening in the wall of the galvanizing vat. The opening may be provided with a stuffing-box so that no fluid can escape from the vat.—*Translated and abstracted from Elektrotechnischer Anzeiger (Berlin), July 25.*

ELECTRICITY IN THE BIBLE.

It is very probable that electricity was employed by civilized peoples of ancient times, especially by priests, for producing certain physical phenomena which would make supernatural impressions on the ignorant masses, says E. Stadelmann. The knowledge of such phenomena and their skillful use for religious purposes was confined to the priests, who carefully guarded their secret. A number of bible incidents are referred to in support of these statements. Thus it appears that the lightning conductor was known to the old Israelites, for the spears on the temple were connected by chains with two iron columns which ended in a water reservoir, essentially the arrangement of lightning conductors of the present day. In examining the construction of the ark of the covenant, it will be seen at once that it consisted of an insulating vessel covered by metal inside and outside and constituted a large Leyden jar or condenser. This condenser was charged by atmospheric electricity by means of the metal-covered columns of the temple hall. The discharge from this condenser was probably powerful enough to kill any one coming in contact with the two metal coatings, and only the initiated could approach the ark. The officiating priests were protected against harm from these discharges by their dress, which consisted partly of gold tissue. Although the altar is not exactly described, the indications are sufficient to permit the assumption that this, also, was a large Leyden jar, and the sacrificial offering was probably ignited by the artificially produced discharge of this condenser. Moses very likely gained his knowledge of electricity from the Egyptians.—*Translated and abstracted from Elektrotechnischer Anzeiger (Berlin), July 25.*

LARGE ELECTRIC FURNACES.

The electrothermal industry, as represented by processes utilizing extremely high temperatures in the electric furnace, has recently increased in importance and extent to an enormous degree. The manufacture of carbide, which is the pioneer of these industries, is technically farthest developed. Great progress has been attained during the past few years by the introduction of very high furnace loads, especially by Dr. A. Helfenstein, of Vienna. This is of the greatest importance not only for the carbide process, but also in the rational manufacture of ferro-silicon and similar products. The greatest load on a single electrode in a furnace, which has so far proved practicable in permanent operation, is said by Helfenstein to be 2,500 to 3,000 kilowatts, namely, 30,000 to 40,000 amperes at seventy-five to ninety volts furnace tension, which means, in three-phase furnaces (in which alone they are at present employed), a total load of 7,500 to 9,000 kilowatts, or 10,000 to 12,000 horsepower. In the manufacture of carbide, however, a further step in advance has been made by the construction of double



ELECTRIC FURNACE FOR A 10,000-HORSEPOWER LOAD.

three-phase furnaces with a load capacity of 18,000 kilowatts, corresponding to a carbide production of eighty to 110 tons in twenty-four hours. But as regards the single-reaction furnace a point has been reached with loads of about 3,000 kilowatts, at which a further increase necessitates a complete change in the method of operation, as well as apparatus built on new principles. This practical limit in the load on single electrodes in open furnaces is due, in the first place, to the great heat of the reaction gases burning in the furnace, so that even with less than 3,000 kilowatts, special protective arrangements are necessary for the workmen and the current-conducting devices. A further current increase would make these devices so complicated that their adoption would not be profitable. Another impediment in the development of the open furnace is the smoke evil, which naturally grows with increasing load. In the manufacture of carbide, and especially of ferro-silicon, it assumes such proportions at loads of 3,000 kilowatts on single electrodes, that it is not admissible for sanitary and other reasons. But the most serious obstacle to a further increase in the load on single electrodes is the question of charging the furnace. The usual method of charging by hand with shovels becomes inadequate, and there is danger that the furnace will not be properly covered and material will be lost. Furthermore, the question of a rational and economical utilization of the energy in the furnace gases becomes more important. The furnace constructors are thus actually compelled to build closed furnaces in order to utilize the reaction gases. By closing the furnace and making use of the gases, the heat and smoke evils, which prevent a further increase in the load, are removed, and the question of continuous and mechanical charging finds its natural and practical solution. It is in this direction that Dr. Helfenstein has recently made important improvements. The accompanying illustration shows a single electric furnace, partly in section, designed upon these lines, for a load of 8,000 to 10,000 horsepower. About eight to ten metres above the base of the furnace there is a gallery for transporting the mixture to the charging apparatus in dump cars at equal time intervals. The charging apparatus consists of a spacious reservoir over the furnace pit, which can be closed air-tight. Through its center passes the easily adjustable electrode (3,000 to 4,000 kilogrammes in weight for 10,000 horsepower), which is surrounded by the mixture on all sides during operation. Large supply tubes extend from the reservoir, which holds 5,000 to 7,000 kilogrammes of material, up to the charging gallery, and by means of this arrangement the mixture is made to flow continually along the electrode in the measure the process requires into the smelting furnace. Broad slots in the roof of the furnace, which can be hermetically closed, permit the detection of any disturbance in the process. In the large three-phase furnaces for 25,000 horsepower three separate electrodes are employed and a charging arrangement is provided for each of them. Helfenstein's method of removing and utilizing the gases cannot yet be described on account of patent questions.—*Translated and abstracted from Zeitschrift für Elektrochemie (Halle), August 1.*

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The Robbins & Myers Company—"A Successful Enterprise."

When the results of twenty-odd years of persistent endeavor to build up and establish a reputation for high quality of apparatus and undisputed recognition of business integrity can be summed up as "A Successful Enterprise," it is fitting that some analysis be made of the efforts which have contributed toward this consummation. At a time when the wheels of progress are turning busily, and when there is every prospect of an era of unparalleled prosperity for the industry of the nation, it is interesting to chronicle the growth and development of an organization which has made steady progress through all the vicissitudes of business depression, change in the art, and continually increasing demand for material to meet severe conditions of service.

The Robbins & Myers Company, of Springfield, Ohio, was organized about twenty years ago for the making of gray-iron castings. After a number of years of gratifying success in this business the company found itself in possession of a plant and facilities that would warrant the undertaking of a regular manufacturing enterprise. In 1897 the company commenced the manufacture of direct-current, motor-driven ceiling fans, becoming one of the pioneers in a practically undeveloped industry. Few people realize the severity of the service demanded of an electric fan. It is almost invariably placed in the hands of people unfamiliar with electrical apparatus, and must be so designed that it will run for long periods of time without attention, and it must also be suited for use in any climate and any temperature in which people can live. A proper recognition of this condition set the company about producing a practically indestructible motor. The results of its efforts are demonstrated by the thousands of ceiling fans produced during the first years of its connection with the industry which are still in successful operation.

The sales of this apparatus increased so rapidly that in three seasons larger facilities were necessary, and at this juncture the company purchased a large three-story factory building, which the business depression of the early nineties had rendered vacant, and which was located adjacent to their original property. By this time the company had added a line of desk fans and had also commenced the manufacture of power motors.

At this time the designing of small motors along first-class engineering lines had not been developed to any considerable extent, and as rapidly as possible after getting into its new quarters the company developed a line of direct-current motors ranging up to fifteen horsepower. New frames were added from

C. F. McGILVRAY,
President Robbins & Myers Company.

time to time, and in a short time the company had established a universal reputation for the quality of its product. Once again, at a period of financial depression, the company found itself ready to take on more business and enlarge its facilities, and early in the winter of 1908 a new factory was made ready for occupancy. The views accompanying this article illustrate to a partial extent the facilities which the company now possesses for the manufacture of its various lines of apparatus.

The present manufacturing facilities consist of a series of buildings grouped around a cement-paved area. There is a new machine shop and motor department housed in a two-story structure, with a saw-tooth roof, having a northern light exposure. The second floor of this building is in the form of a gallery, with a clear story down the center aisle, leaving all portions of the building exceptionally well lighted. Every attention has been given to securing comfortable working conditions for the employes, all modern sanitary appliances being provided.

The company operates its own water-works system, taking its water from one of the underground springs which gives the city its name, is amply equipped with fire protection, and uses natural gas for its power plant. The power plant consists of two large double-cylinder horizontal gas engines, direct-belted to generators from which power is delivered to large switchboards located on the main testing floor. The various machine motors, about 150 in all, are connected to a three-wire system of distribution, the machines being divided into convenient groups, each group being driven by its separate motor. The larger tools are individually equipped, and the various elevators throughout the plant and a large number of individual special machines which the company has found necessary to build, are driven by individual motors.

The equipment of the winding room is worthy of special mention, the company having designed and built for its own use a complete equipment of winding machines, able to handle a wide range of armatures and field coils, improving on hand operation, and greatly increasing the possible output.

In line with the improvement of special machinery for the production of motor and fan parts, the company has spared neither money nor effort in the equipment of its testing department. One of the prime requisites in a successful electric fan is cleanliness and noiselessness of operation. A room is set apart, as far as possible from any moving machinery, and specially equipped as a fan-testing room. Every fan is given a run under full load of sufficient duration to develop its maximum running temperature, and the fan is under constant inspection during this time.

In the motor department the same thoroughness is in evidence, each motor being tested both under full load and under its guaranteed overload. The other departments of the works have been given the same careful attention as regards detail of manufacture and rigidity of in-

spection and test. The shipping department is located with reference to one of the company's private switches, which greatly facilitates the loading of cars for carload shipments. Large stocks of apparatus are kept in hand for immediate delivery, and the storage capacity has been so increased that the company can now carry from five to six thousand assorted fans in stock without crowding.

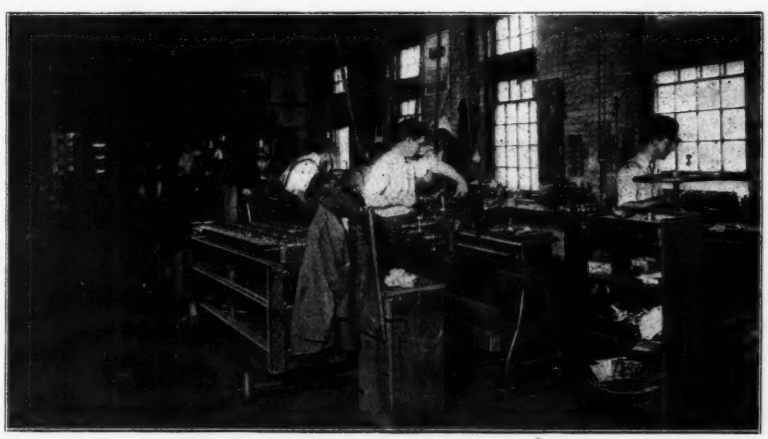
A considerable portion of the company's motor business consists of motors for special applications to direct-driven apparatus, and a large number of special types of motors have been facilitated by a well-organized engineering and experimental department. As the mechanical work of this department is carried on entirely independent of the general manufacturing, new special work is produced with great facility and without interfering with the regular output of standard apparatus.

PRIVATE OFFICE OF PRESIDENT AND GENERAL MANAGER.

OFFICE OF SALES MANAGER OF MOTOR DEPARTMENT.

OFFICE OF SALES MANAGER OF FAN DEPARTMENT.

The development of the plant has been harmonious in all its details. The old practice of carrying iron in ladles and pouring off has been replaced by a modern trolley leading to all parts of the foundry. Molding machines have been installed in large numbers, and the company has adopted the electric drive in its foundry wherever the application has been found possible. Of late years, the company has enjoyed a very successful business in the manufacture of resistance grids, the ability to control at all times the chemical qualities of its iron being of inestimable advantage to the electrical manufacturing department.



GROUP OF ARMATURE FINISHING LATHES.

The fan business was commenced by the development of a single type of large-blade ceiling fan, which is still known as the "Standard" fan, Style A. This is a high-priced fan, and its design and construction was based, and has been kept upon a high ideal of performance and artistic appearance. Several additions have been made to this line in the form of double and three-blade fans, to meet the demand for a high-powered fan at a lower cost. The company early developed a line of swivel and trunnion fans in connection with its desk and bracket line, and as early as 1904 secured patents and began making an oscillating fan. Recently there has been developed a smaller model of fan for use in residences and small offices. The company also manufactures exhaust and ventilating fans of various types and capacity.

In the manufacture of its "Standard" motors and generators the company enjoys a most enviable reputation. Durability has been secured by careful design, liberal proportions, and the use of the best obtainable material and the highest grade of workmanship. These motors have been adapted to many special classes of service, and the line is so extensive that about fifty per cent of all conceivable motor needs can be met from catalogue selections of "Standard" frames and ratings.

The plant of the company is very pleasantly located just on the outskirts of the city of Springfield. There is at all times surrounding the works an atmosphere of country freshness, and the enterprise manifested by the whole organization is in keeping with the choice surroundings of its plant. The main offices of the company are conveniently located at the

northern end of the manufacturing plant on two sides of the building, with the private offices of the secretary and the general manager at the apex. The main entrance is into a general office, where

PORTION OF WINDING ROOM.

MAIN AISLE OF THE MACHINE SHOP.

the reception room and telephone facilities are located. The other offices are divided into departments for the motor-sales department, fan-sales department, and accounting department, equipped

VIEW ON MAIN TESTING FLOOR.

FAN BLADE ASSEMBLY ROOM.

with every modern facility in the way of card-index and filing systems, rapid circular addressing and printing apparatus, follow-up systems, adding machines, etc.

The various heads of departments are kept in touch with each other and with the entire manufacturing establishment by intercommunicating-telephone systems, each department also having connection through an internal exchange with local and long-distance lines.

The company has established offices in practically all of the larger cities, where complete stocks are maintained in addition to well-equipped and stocked first-floor stores in New York, Philadelphia, and Chicago. Its entire South American business is conducted from its offices in Buenos Aires, and its English and East Indian trade through prominent London engineering firms. The company is also represented and enjoys a large trade in Australia, so that its products are sold and well known in practically every quarter of the globe.

A manufacturing plant, no matter how well equipped, would be of little avail unless it were managed by a strong, intelligent personnel. The growth and development of this company is typical of American industry and enterprise, and is a fine example of business acumen plus modern manufacturing facilities. The officers and sales managers of the company are: C. F. McGilvray, president; H. E. Myers, vice-president; W. J. Myers, treasurer; W. A. Myers, secretary; H. B. Ramey, sales manager motor department, and W. W. Mumma, sales manager fan department.

GENERAL FAN ASSEMBLY ROOM.

New Motor-Starting Switch for Printing Machines.

A new type of motor-starting switch for use with printing machines is described in a recent issue of *The Times (London) Engineering Supplement,* from which the following is taken. Some of the features are quite novel.

Every printer and every printer's engineer is aware that the starting of printing presses is very hard on the switchgear, on account of the constant starting and stopping of the motor (or "inching"), which is necessary when preparing the press. This constant "inching" causes most injurious arcing on the contacts of the starting switch, with the result that ordinary starting switches are soon destroyed, and even though renewable contacts may be used, the renewals are required so frequently as to become a nuisance as well as a serious expense.

With the object of rendering ordinary hand-operated starters suitable, such devices have been employed as carbon auxiliary contacts, magnetic blow-outs, and interlocked solenoid switches. These devices have failed because they have protected only the first step, whereas the attendant, whose eyes must be on the machine and not on the starter, pulls the handle, when "inching," over to the third or fourth contact, or perhaps further, and in moving it back draws a destructive are across the starter steps.

In the new switch there is an interlocked magnetic circuit maker and breaker, but the essential merit of the arrangement consists in the fact that no matter how far the operator pulls the handle over in a forward direction, the slightest backward movement instantly opens the circuit-breaker. Consequently no arcing can occur on the starter steps because they are "dead." With this starter, therefore, "inching" may be practiced to an unlimited extent.

The new switch is manufactured by the Adams Manufacturing Company, Limited, of Bedford, Eng.

Signs of Prosperity.

The rapidly increasing demand for rolling stock to take care of growing traffic on steam railroads, particularly in the West, is indicated in no small measure in the list of orders for car equipments made public recently by the United States Light and Heating Company, of Maine, with executive offices at 30 Church Street, New York city. During the last month the company received orders to equip no less than 240 cars, of which eighty-eight are for the Western Pacific. The other orders came from the Santa Fe, Denver & Rio Grande, Ann Arbor, Minneapolis & St. Louis, Pennsylvania and Erie.

Meter-Testing Rheostat.

In calibrating service wattmeters it is the general practice to use an artificial load. The device commonly employed for this purpose—a bank of incandescent lamps—is far from satisfactory, on account of its size and weight, and is uneconomical because of the expense of lamp renewals. The meter-testing rheostat, illustrated herewith, a recent product of the General Electric Company, is especially adapted for testing service, as it has small dimensions and weighs only seven pounds. Fig. 1 shows the rheostat complete.

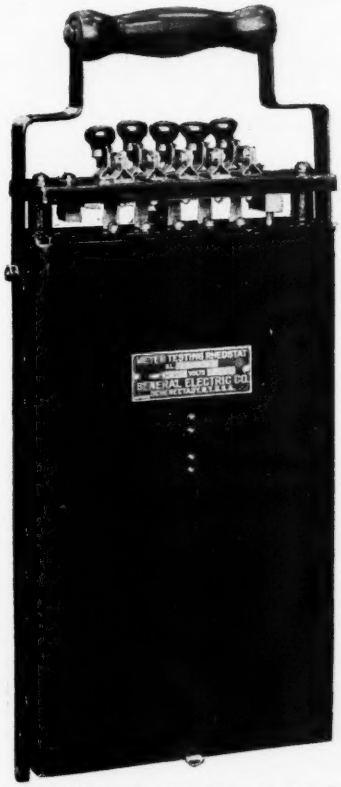


FIG. 1.—METER-TESTING RHEOSTAT COMPLETE.

As may be seen from Fig. 2, several resistance units are supported by a sheet-metal frame, and connections are made to knife switches, mounted on a small terminal board. Each switch is marked with the value of the load which it controls, the steps being arranged to give loads from one-half to fifteen amperes in one-half-ampere increments. On the inner side of the terminal board are two binding posts, into which the line wires are inserted and fastened by set screws. The sides of the box are hinged and serve as supports when the rheostat is in use. The resistance metal is non-corrosive and has a low temperature coefficient. It is wound on a fireproof body and the complete unit is covered with a protecting compound. The rheostat is neatly finished in black japan.

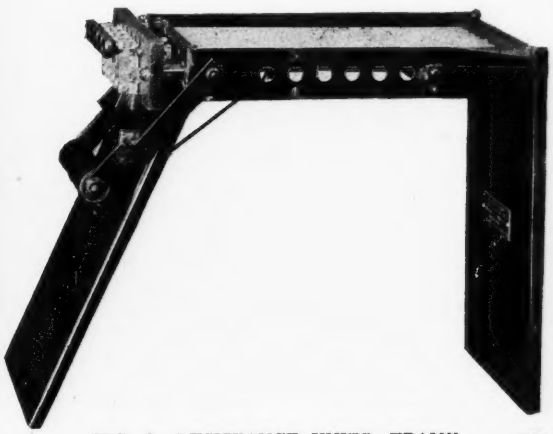


FIG. 2.—RESISTANCE UNITS, FRAME, KNIFE SWITCHES, ETC.

Some New Westinghouse Installations.

The Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., reports the following important new business:

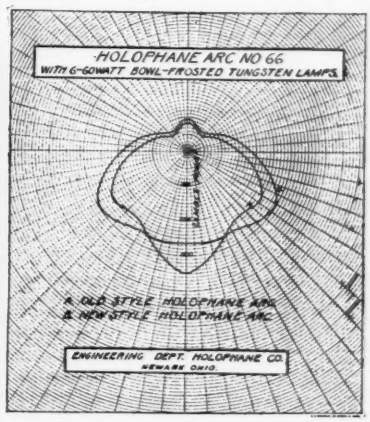
The new power plant of the Southwestern Portland Cement Company, El Paso, Tex., will contain two 600-kilowatt Westinghouse steam turbines driving 750-kilovolt-ampere, Westinghouse revolving-field alternators, delivering sixty-cycle, three-phase current at 440 volts. Excitation current is furnished by a fifty-five-kilowatt, 125-volt Westinghouse engine-driven generator, and by a motor-generator set, comprising fifty-five-kilowatt and twenty-kilowatt direct-current generators, driven by 115-horsepower type CC1 induction motor. The turbines exhaust into Westinghouse LeBlanc condensers, which maintain a vacuum of twenty-eight inches. The motor equipment of the mill, also Westinghouse apparatus, comprises a number of type CC1, three-phase, 440-volt, induction motors of both vertical and horizontal types and ranging over 100, seventy-five, fifty, thirty, twenty, fifteen, ten and five-horsepower capacities, besides a thirty-five-horsepower HF motor, and one to five-horsepower SA variable-speed motor. All motors are furnished complete with starting apparatus, by the Westinghouse company. The power plant of the Southwestern Portland Cement Company supplies lighting service in addition to operating the cement mill.

A 2,500-kilovolt-ampere Westinghouse alternator, driven by a 2,000-kilowatt Westinghouse steam turbine, has been ordered for furnishing light and power service to the Erwin Cotton Mills at West Durham, N. C. The steam element operates at 175 pounds pressure and exhausts into a vacuum of twenty-seven inches. The power distribution will be made with three-phase, sixty-cycle current at 600 volts. This property is the largest among the great cotton-mill interests of the Dukes, of the American Tobacco Company.

New Features of Holophane Arcs.

Holophane arcs, made by the Holophane Company, Newark, Ohio, have won renewed popularity since the improvements in tungsten lamps made it possible to burn them at any angle without appreciable effect on their life. They are being offered for the coming year with many new features.

Most important of the features of 1911 Holophane arcs is the new Holophane glass equipment, by the use of which a much better distribution of light is secured. The comparative curve herewith illustrated shows how great is the improvement in this regard of the new units over the old.


HOLOPHANE ARC NO 66
WITH 6-60WATT BOWL-FROSTED TUNGSTEN LAMPS.
A OLD STYLE HOLOPHANE ARC
B NEW STYLE HOLOPHANE ARC
ENGINEERING DEPT. HOLOPHANE CO.
NEWARK OHIO.

COMPARATIVE DISTRIBUTION CURVES OF NEW AND OLD HOLOPHANE GLASS.

A separable cluster body also is now supplied, so that the new Holophane arcs can be taken apart and the glassware cleaned without breaking the connection.

The standard finish of Holophane arcs in future will be brush brass. Square-linked chain is used for the suspension and a separable canopy is supplied which does away with the necessity of a long nipple at the ceiling.

Harriman Has Crossed the Rubicon.

The work of constructing power houses along the Rubicon River, in California, for electrifying the mountain division of the Southern Pacific Railway has been started. Thus has E. H. Harriman indeed crossed the Rubicon—from steam to electricity.

New Line of Central-Office Telephone Switchboards.

The Western Electric Company is offering to the trade a complete line of non-multiple central-office switchboards, known as the No. 1200 series. These switchboards are made up in one and two-position sections, each type of section having three different capacities, as for example: Sixty, 105 and 165 lines to a position. Each of these different sections is furnished with eight different types of equipment, as follows:

1. Magneto equipment with self-restored line signals. (Code No. 2.)
2. Magneto equipment with manually-restored line signal. (Code No. 4 for selective lines; Code No. 56 for bridging lines.)
3. Magneto equipment with electrically-restored line signal. (Code No. 34.)
4. Magneto equipment with electrically-restored line signal (Code No. 34), arranged for conversion to central-battery service.
5. Central-battery equipment with magnetic line signal. (Code No. 34.)
6. Central-battery equipment with lamp-line signal.
7. The magneto switchboards are arranged to be additionally equipped with ringers for operation on exceedingly long lines or on lines where audible code signaling is desired.
8. The central-battery switchboards are arranged to be additionally equipped with a No. 2 combined jack and signal for operation on rural lines.

All of these switchboards are furnished for operating with standard ringing systems, such as one-way, two-way, two-party, four-party pulsating, four-party harmonic, eight-party harmonic, etc. They are also furnished for single or double supervision. The double supervision cord-circuits used in these switchboards are guaranteed to prevent "ring-through" or "hang-up" difficulties.

When desired, these switchboards can be equipped with through toll-line circuits (sometimes known as "cut-in-stations"), audible code ringing on each of the line circuits, etc.

The Western Electric Company is offering in connection with these switchboards a standard line of accessories, such as lightning arresters, cabinets, calculagraph sections, calculagraph shelf extensions, cash-drawer shelf extensions, etc. It will be noted that this line of switchboards and accessories will fulfill every known telephone condition.

The general outline of these switchboard sections is such as to present a neat, practical and pleasing appearance. Fig. 1 illustrates a two-position section equipped with No. 2 combined jacks and signals.

Fig. 2 illustrates a one-position section arranged for magneto use, the line circuits in which are equipped with No. 34 signals for the city lines and a No. 2 combined jack and signal for the rural lines.

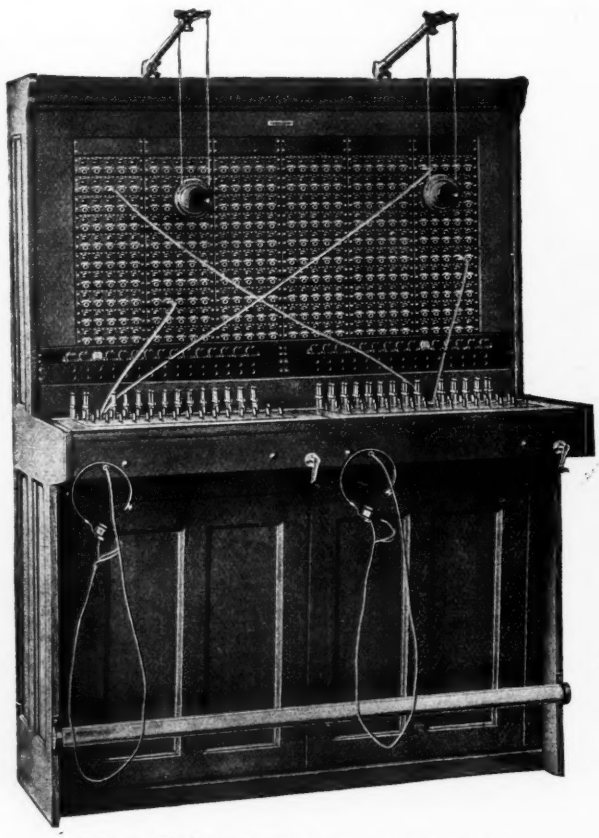


FIG. 1.—FRONT VIEW OF NO. 1250 SWITCHBOARD.

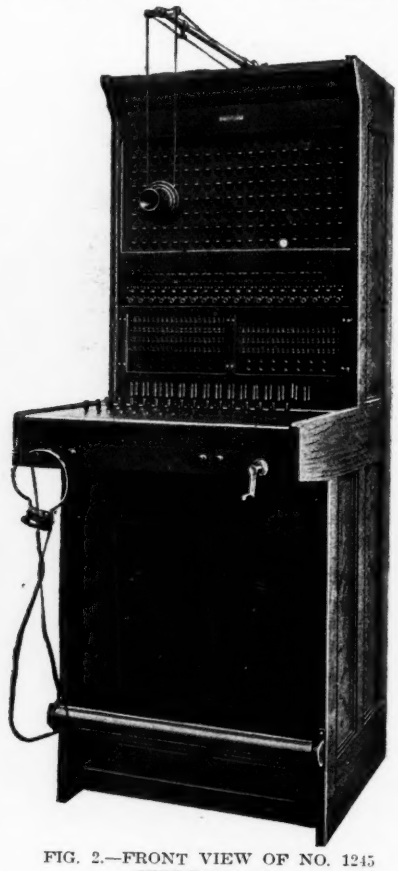


FIG. 2.—FRONT VIEW OF NO. 1245 SWITCHBOARD.

Some novel features of construction will be found in this section. All joints in the woodwork are tongued and grooved and securely fastened with a fine quality of glue and further reinforced with steel angles. The key shelves of these sections are strengthened by steel bars to which the operator's keys are fastened by means of machine screws. This not only insures a perfect alinement for the keys, but permits of their easy removal should occasion require. The key shelves are hinged by means of a piano hinge extending the full length of the shelf. This arrangement very materially strengthens the key shelf and plug shelf and also adds to the appearance of the switchboard. The exterior surface of the sections is finished with a rich, golden-oak finish. The outer coat of varnish is hand-rubbed and of such a character as not to scratch easily or to show ordinary wear.

These switchboards are equipped with Western Electric Company's Bell type of apparatus throughout. Many interesting features will be noted in connection with this apparatus. The No. 2 combined jack and signal used on the line circuits of the self-restored signal type of switchboard represents a radical departure from any previous design of magneto signal. The signal is given by means of an indestructible revolving steel ball, the visible portion of which changes color when operated. A portion of the surface of this ball projects out from the faceplate in such a manner that the signal can be seen from the side as well as from the front. One of the great advantages of this type of signal is that there are no projecting surfaces on the face of the board that are liable to injure the hands or tear the clothes of the operator. Another novel

feature of this signal is the circular armature that is made use of in order to permit of readily removing the coil from the signal. By means of the circular armature, none of the line connections are disturbed in any way, and no parts of the signal that enter into the adjustment of the same are disturbed. The coil is removed by the simple operation of removing a single screw. Especial attention has been given to the night-alarm attachment. The circuit is completed through two platinum-pointed springs that are attached to each of the signals, which springs make contact when the signal is operated. These springs are located in an accessible position behind the face-plate so that the operator can in no way injure the same.

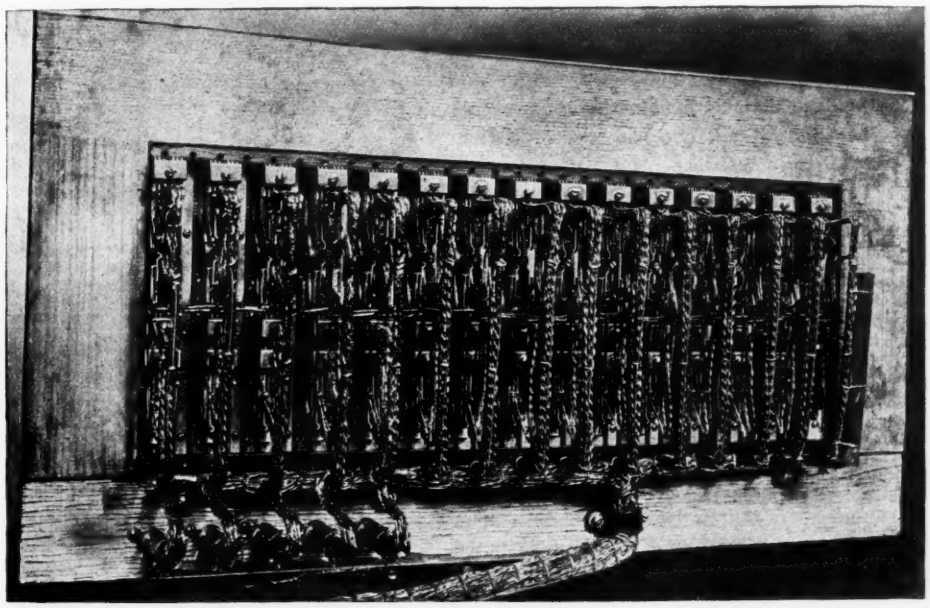


FIG. 3.—SHOWING KEY SHELF THROWN OPEN.

The No. 4 and the No. 56 type drops which are used in the manually-restored type of switchboards are of the standard Bell type, which has been manufactured for the last fifteen years.

The No. 34 signals, used in the electrically-restored time-signal type of switchboards, both for magneto and central-battery operation, have been thoroughly tried out in service. There is a total of about 1,900 switchboard sections in operation today that are equipped with these signals. The keys that are used in these switchboards are of the well-known No. 102 type. They are equipped with horizontal springs that are mounted on edge in blocks of hard rubber. By means of this construction it is possible for the trouble-man, upon opening the key shelf, to clearly see at a glance whether or not any trouble or obstruction is in the key springs. This feature is shown in Fig. 3. This renders it seldom necessary to remove the key from the key shelf.

The cords used on all of these switchboards are of the flat steel wire type, which are renowned for their long service.

In the design of all of the apparatus used in these switchboards, especial attention has been given to the high efficiency of operation and also to a low maintenance expense. Especial attention has also been given to the location of the apparatus in the switchboard sections. The result is that all of the apparatus is easily accessible, and the services of an expert are not required in order to maintain these switchboards.

The First Modern Telephone Plant for China.

On Wednesday, August 4, the export department of the Western Electric Company received from Pekin, China, a cablegram stating that a contract with the Chinese government to supply a complete common-battery telephone plant for the city of Pekin had been signed. The Chinese government, through the president of the Board of Communications, had ratified the sale, which came as a result of negotiations of a year's standing.

This order was secured by the American company only after the most strenuous competition, in which the largest telephone manufacturers of the world figured. To gain a foothold in China—absolutely a new field for telephones, and one giving great promise for future development—seemed more than desirable to the large manufacturers. It is considered quite a victory for American methods.

Heretofore, almost nothing in the way of telephone development has been accomplished in China. There have been telephones in only a few of the cities, and these largely in the foreign quarters, which were served by small out-of-date systems. The two switchboards sold by the Western Electric Company to the government are the first common-battery boards in the entire empire, yet China has an estimated population of over 400,000,000. Our own country, with a population but one-fifth as large, has more than 1,000 telephone exchanges larger than the two intended for Pekin, besides fully 15,000 smaller ones in smaller cities and towns. This gives some idea of the magnitude of the field still to be opened in the far East.

Though only two exchanges so far have been ordered, this is considered as but the beginning of a system that will eventually be fully developed throughout China. The Board of Communications not long ago formed what was known as the International Chinese Telephone Administration. Last fall F. M. Dresing, foreign adviser of this body, while on an American tour visited the Western Electric Company, and made known the desire of the Chinese government to buy some telephone equipment. Chinese commissioners visited this country, inspected the telephone plants of the large cities and were shown through the shops of the large telephone manufacturers. The Western Electric Company sent a special emissary to Pekin, and the result of his efforts has just been announced.

The order amounts to about $150,000, and covers a complete telephone plant of the most modern type, including several hundred thousand feet of lead-covered aerial and underground cable. The contract calls for complete delivery at Tientsin by February 3, 1910, allowing but six months for manufacturing and delivering to the Chinese government. The work of installation will be done under the supervision of one of the Western Electric engineers, who will be sent to Pekin for that purpose. It may be noted that this new order of things is attracting the attention of the entire press.

Porcelain Electrical Specialties.

The Mechanical and Electrical Manufacturing Company, 54 North Desplaines Street, Chicago, Ill., is the maker of a comprehensive line of porcelain electrical specialties. These include porcelain pendant waterproof sockets and wall sockets, outlet boxes and festoon sockets, sign sockets and open-type sockets, combination outlet-box cover and open-type socket. Also a combination with a waterproof socket, combination metal outlet-box cover and open-type socket with steel covers and with steel fiber-lined covers; with brass covers and brass fiber-lined covers; lined and unlined metal outlet-box covers, and porcelain bushings for metal and wood.

COMBINATION OUTLET-BOX COVER AND WEATHERPROOF SOCKET.

These porcelain specialties are made to withstand every degree of weather. The shells are made of copper, and brass screws and nuts are used in attaching the copper terminals to the shells and porcelain buttons. The shells are removable when replacing is necessary. A copper washer is used for the center terminal inside the shell. The copper terminal connections are perfectly made, and there is no waterproofing material between the outer side of the shell and the inner side of the porcelain.

The accompanying illustration gives a good idea of the appearance of one of these specialties.

Excello Series Flaming Arcs in Michigan Avenue, Chicago.

The article in the issue of August 14 describing the series flaming-arc lamps installed by the Excello Arc Lamp Company for the South Park Commissioners on Michigan Avenue, near Twelfth Street, Chicago, has attracted considerable attention. In this connection an error should be pointed out. The main office of the Excello Arc Lamp Company is in New York, H. M. Hirschberg, president; R. F. Pierce, sales engineer. The Chicago office is in charge of G. W. Armstrong, western manager.

New Substitute for India Rubber.

A. G. Inrig has patented in Great Britain and Germany a new process for making a substitute for india rubber. The materials used are animal refuse capable of yielding gelatin, oils, sulphur, chromates and sodium stannate, the addition of the last-named salt being the distinguishing feature of the process. The proportions recommended are animal refuse 100 parts, water fifty parts, oil twenty to sixty parts. These ingredients are stirred together for about an hour and then one per cent of potassium bichromate and one per cent of sodium stannate are added. The mixture is then heated to about 212 degrees Fahrenheit, and kept at this temperature about five minutes, or until the previously liquid mass becomes pasty, in which condition it is poured into molds. A harder and tougher mass is made by adding twenty per cent of oil, one per cent of sodium stannate, one per cent of potassium bichromate, and five to ten per cent of sulphur, and heating the mixture to 257 degrees Fahrenheit.

The Kimble Variable-Speed Alternating-Current Motor.

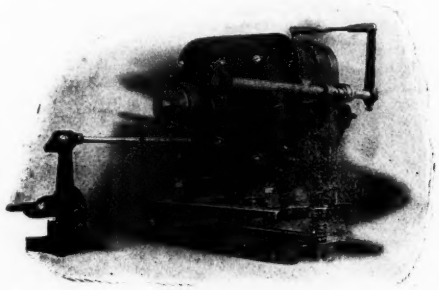
One of the most striking successes of recent inventions of interest to the industrial power user, particularly to the printer, is the Kimble variable-speed alternating-current motor. During the four years that it has actually been upon the market, this motor has been installed in hundreds of plants of various kinds, and the manufacturers have been obliged to enlarge their factory and equipment three times.

The installation of the alternating-current single-phase motor has not been particularly satisfactory to the printer, as in many cases there has been a large consumption of current due to the excessive demand of the motor in starting up, and there has been an uneconomical consumption of current due to the increased energy requirement because of the low power factor.

Printing press requirements necessitate a variable-speed motor which has been obtainable only by the installation of costly and intricate auxiliary devices. These were expensive, were not easy of control, and many times did not possess ruggedness of construction to make a good showing in service.

The increasing demand for alternating-current networks for other services made imperative the development of a thoroughly reliable alternating-current single-phase motor; and in meeting this demand, the Kimble Electric Company has been particularly fortunate. The motor starts with a full-load current and is started, stopped and reversed, and its speed controlled all from a single lever contained within the motor itself.

The accompanying illustration gives a good idea of the appearance of this motor and its lever connections. The lever is operated by a foot treadle, and outside of the wiring connections there are no exterior apparatus or devices. The speed range is from 300 to 3,000 revolutions per minute and the motor runs very quietly.



KIMBLE VARIABLE-SPEED ALTERNATING-CURRENT MOTOR.

The Kimble Electric Company, 1121-1123 West Washington Boulevard, Chicago, Ill., is the manufacturer of this motor. The company also makes variable-speed reversible ventilating fans and other industrial power apparatus.

Westinghouse Storage-Battery Company.

The Westinghouse Storage Battery Company, which was incorporated July 12 last, has acquired all of the plant, patents, and equipment of the storage-battery department of the Westinghouse Machine Company and of the General Storage Battery Company, and will manufacture, at Boonton, N. J., both the Westinghouse and Bijur types of storage battery for those classes of service in which each has proven superior. The Westinghouse Storage Battery Company enters the field with greatly increased manufacturing facilities and the best engineering talent obtainable, and will maintain thoroughly equipped testing and commercial laboratories, insuring uniformity of both materials and product. The general offices of the company will be located at Boonton, N. J., with sales offices in the principal cities of the country. Both the Westinghouse and Bijur storage batteries have been on the market for many years.

Current Electrical News

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, AUGUST 8.—The following new companies have been formed on the Continent: Robinovitch and Marcat, electrical supplies, Paris. L. Cazelle and Company, electric installations, Toulouse. Penin and Leclercq, electric apparatus and automobiles, Lille. Narici and Castiglia, consulting engineers, Turin. Brivio and Company, gas, water and electricity, Milan. Leoni and Company, electrical machinery, Milan.

The new underground subway at Vienna for carrying mail matter is likely to be realized in the near future. According to the present plans, the subway will consist of a tunnel lying twenty-five feet below the surface and having a five by four-and-one-half-foot section. On the tracks will run light trains carrying letters, printed matter and packages, and the subway line is to connect the main post office building with sixty-four branch offices in the city, and also the leading railroad depots. The train will be run without a motorman and will be controlled from a central post.

Connection between the Varese-Masnago electric line and the Lago Maggiore, Italy, is to be made by a new electric road which connects with the former at Masnago, and it will proceed from this point to the locality of Angera, on the shore of the lake. From here the steamboat service on the lake will allow passengers to reach Arona, on the opposite shore, within ten minutes. The new section of electric line will therefore be of good service for the traffic in this region.

The Spanish government has lately voted a credit of $20,000 for the purchase of scientific apparatus, including high-grade measuring instruments, for the different public laboratories and the technical institutions in the principal cities.

It appears that the project which has been agitated in Berlin for some years past regarding the construction of the metropolitan subway is now in its final stages. Owing to various difficulties, the subway project, which was voted in principle by the Municipal Council some four years ago, could not be carried out. At present the greater part of the difficulties have been met with, and recently the emperor gave his approbation to the scheme. The line will connect the northern and southern districts of town and is to have fourteen stations. There is also some talk of extending the line to the suburbs on an overhead structure, as well as erecting other lines within the city. The cost of the project is estimated at $20,000,000.

The work on the new Mont Blanc Railroad has been making considerable progress of late. It will be remembered that the line is operated on the rack-rail system, and that it is to eventually reach the high peak known as Aiguille du Gouter, which is one of the highest points to be reached by ascensionists, but at present it is a very difficult matter to make the climb to this point. The new railroad is to have an 875-millimetre gauge, using rails weighing twenty kilogrammes per metre, laid on metallic ties. Between the rails is laid the rack rail, which is designed on the Strub system, having a rail head for the use of a grip brake, so as to keep the car on the track. The line starts at the terminus of the Paris-Lyons-Mediterranean branch railroad, which runs from Geneva to Fayet, this latter point being also the starting point of the Fayet-Chamonix electric line. It will take about four hours to reach the Aiguille du Gouter by the new railroad, and from here the summit of Mont Blanc can be reached on foot in five hours, including the return, so that the whole trip will take about thirteen hours.

A new company has been formed in Italy for the supply of current for industrial purposes, which is to have a considerable scope. It is known as the Rosario Valley Company, and its headquarters are located at Spezia. One of the enterprises which it will undertake in the first place is the equipment of a traction line running from Spezia to the Hunigiana region, and having its terminus at Fivizzano. The line runs through a district which has abundant natural resources, and is besides well populated, so that it is sure to be well patronized and will aid in developing the region.

The appointment of M. Millerand as one of the ministers of the new cabinet and the chief of the postal, telegraph and telephone service is likely to bring about a reorganization of the telephone service especially. M. Millerand states that he recognizes the defects in the Paris telephone service, and will take measures to remedy these so as to place Paris on the same footing as the other capitals in this respect. The troubles with the employes will now likely come to an end, and this will be a great relief to the public. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, AUGUST 14.—The city of Toronto, Ont., now receives over $2,070 per day, in percentages alone, from the Toronto Street Railway Company.

There are now no obstacles, it is said, in the way of the company which proposes to construct an electrical line in the Cobalt district. The chief engineer of the Nipissing Central Railway has been in Ottawa to place the location and structural plans for the railway before the Railway Commission and the Department of Railways. The plans were approved by both departments.

The old Beauharnois Canal, although of necessity kept in working order, is no longer needed for transportation purposes, having been superseded by the new canal on the north shore of the river. The old canal has, through its important system of retaining dams, afforded a site and valuable waterpower to the manufacturing town of Valleyfield, Que. Its exceedingly valuable water privileges have been acquired by the Canadian Light and Power Company, which intends to transmit electric power to Montreal. The company intends to develop 21,000 horsepower there.

The contracts for the remaining eight stations of the Hydro-Electric Power Commission's power line have been let to the lowest tenders. Edge & Gutteridge, of Seaforth, Ont., were the successful tenderers for the stations at St. Marys, Stratford, Berlin and Guelph. These will cost $18,700 each. The contract for the Preston, Paris, Woodstock and St. Thomas stations goes to John Hayman & Son, of London, for $19,850 each. A contract has also been awarded to Pratt & Letchworth, of Brantford, Ont., the lowest bidders, for the supply of 12,000 galvanized clamps for the carrying of the cable. These contracts complete the large items in connection with the line. All that now remains to be let is mechanical equipment, such as cranes, boiler packing, water piping, etc.

The city of Brockville, Ont., in common with the whole of Eastern Ontario, is just now deeply interested in a scheme to develop electric energy at the Long Sault Rapids, on the St. Lawrence, which, when carried to completion, will stimulate industrial enterprise in this portion of the province. The site of the proposed new power plant is near Cornwall, at the foot of the rapids. The plant is to be constructed, and managed jointly, by two companies, the Long Sault Development Company, on the American side, and the St. Lawrence River Company, on the Canadian side. The latter company already has the power house at Mille Roches, which furnishes light and power for the locks and power and light for Cornwall, but in order to develop more power the two companies have designed a scheme which will be able with ease to furnish unlimited power to the whole of Eastern Ontario at reasonable cost. It is calculated to use the rapids as a headrace for three mammoth power houses, capable of turning out over 100,000 horsepower. It is proposed to divert the waters of the Sault in the proper direction by the construction of a dam over 4,000 feet in length. The constructive work alone is expected to occupy over five years' time, involving an expenditure of some $20,000,000. It is expected that the power can be retailed for $15 per horsepower. The companies are seeking a charter from the Canadian Parliament and the United States Congress, and have made a vast quantity of plans and computations for details. W.

LIGHTING AND POWER.

(Special Correspondence.)

CLARKSVILLE, MO.—E. N. Moody and others have formed a company to put in an electric-light plant.

TULARE, CAL.—The Mt. Whitney Power Company of Visalia, Cal., has bought a site for a substation here.

BISHOP, CAL.—Ben H. Yandell has applied for an electric-lighting and power franchise in Inyo County.

BEMIDJI, MINN.—The Warfield Electric Company has applied to the City Council for a renewal of its franchise. C.

ANTIGO, WIS.—The Antigo Electric Company has been incorporated with a capital of $125,000, by John Manser and others.

DOUGLASVILLE, GA.—The sum of $10,000 electric-light bonds issued by this town have been purchased by the Central Bank and Trust Corporation of Atlanta, Ga., Carter & Gillespie, of Atlanta, having the contract to complete the work on the

lighting system. The bonds were sold, it is reported, for considerably more than par value. L.

WONDER, NEV.—The Round Mountain Mining Company, of which James R. Davis is manager, is to install an electrical equipment.

ALBEMARLE, N. C.—An issue of $27,000 municipal bonds for lights, water, etc., has been carried by a large majority in a recent election in the town. L.

FRESNO, CAL.—Manager A. G. Wishon, of the San Joaquin Light and Power Company, has sent out 400 men to work on the company's dam at Crane Valley.

DOVER, DEL.—The Water-Power Securities Company has been incorporated, with a capital of $765,000, by L. H. Woodruff, J. Welch and B. H. Welch, Philadelphia.

GLENDALE, CAL.—Arrangements are now under way for the purchase from L. C. Brand of so much of his lighting system as is inside of the city limits for $25,000.

EVELETH, MINN.—The lighting plant owned by the Northern Electric Company has been sold to Con Lee, H. E. Griswold and H. W. Irwin, local capitalists, for $50,000. C.

WALLACE, IDAHO—The Interstate Mining Company, Oscar B. Wallace, Wallace, Idaho, manager, will put in the equipment for an electric power plant in the near future.

HAGERMAN, IDAHO—H. A. Stroud and associates, of Hagerman, Idaho, are formulating plans for the installation of a 75,000-horsepower electric plant and the construction of electric car lines.

WINNEMUCCA, NEV.—S. R. Young, one of the valley's most enterprising business men and ranchers, is to install a big electric plant on the Humboldt River, about nine miles from the town of Lovelock.

REDDING, CAL.—Following the injunction issued last week by the Superior Court, the Sacramento Valley Power Company has removed its dam from Old Cow Creek, thus losing 400 inches of its water supply.

PENDLETON, ORE.—The owners of the Lohman Springs property near here are planning to put in a hydroelectric power plant to develop current to supply light and power to the hotel, camp grounds, etc.

GREAT FALLS, MONT.—The village trustees have granted a franchise for lighting the town to G. H. Jay, of Great Falls, Mont. Mr. Jay proposes to install a waterpower plant at an estimated cost of $35,000.

MANCHESTER, N. H.—The Manchester and Derry Electric Company has increased its capital stock from $200,000 to $240,000, and papers have been filed recording the increase at the secretary of state's office.

HAMILTON CITY, CAL.—The Northern California Power Company has completed its power house at this place and a large force is now installing the transformers and placing the cables for its 60,000-volt line.

SALTILLO, MEX.—An electric-light and power plant is shortly to be established at General Cepeda, Coah. The congress of the state has approved the contract of Abel G. Trevino, who will install the machinery.

CORDOVA, ALASKA—The Cordova Power Company announces that it will expend $50,000 in extending its pipe lines to Crator, or Summit Lake. This will require about three miles of pipe and will give a fall of 1,800 feet..

CHAMPLAIN, N. Y.—The North Creek Electric Company, to operate in Johnsburg, Warren County, has been incorporated. The capital is $25,000 and the directors are: Charles S. Wood, John H. Wade, Charles S. Wade, North Creek.

GILBOA, N. Y.—The Gilboa Electric Light, Heat and Power Company has been incorporated, to sell electric light, heat and power; capital, $25,000. Incorporators: Ernest E. Billings, Eli S. Persons, Sidney Rivenberg, all of Gilboa, N. Y.

LUCILLE, IDAHO—Walter Hovey Hill, engineer, and a party of Portland mining men contemplate putting in an electric plant to pump water on the high bar at Lucille, Idaho, for placer purposes. M. S. Heart is manager of the property.

COLUMBIA, S. C.—Reserve power will be furnished the Dudley Shoals Cotton Mill Company, of Granite Falls, by the installation of an auxiliary steam plant of 125 horsepower. It will be used when the company's hydroelectric plant is affected by low water.

WALLA WALLA, WASH.—The John Day Power Company has filed articles of incorporation here. The capital stock of the company is $500,000, the incorporators being N. G. Blalock, Y. C. Blalock, W. J. Mariner and A. D. Lyman. The company plans to develop electric power from the waters of the John Day and Deschuttes rivers.

MODENA, UTAH—The Gold Springs Mining and Power Company is making preparations for the construction of a large power plant at Modena, construction to start as soon as the material is delivered. C. A. Short is president of the company.

FRESNO, CAL.—The Fresno Power Company, of San Francisco, has filed articles of incorporation here. The capital stock of the company is $1,000,000. The incorporators are G. A. Knight, J. M. Ough, H. M. Woolley, C. J. Haggerty and W. M. Madden, of San Francisco.

PATCHOGUE, N. Y.—A mortgage for $200,000 made by the Suffolk Gas and Electric Light Company to the Kings County Trust Company, as trustee, has been filed in the county clerk's office. A recording tax of $750 was paid before the mortgage could be recorded.

CHISHOLM, MINN.—W. M. Pratt, president; L. C. Newcombe, vice-president, and A. C. Schirmer, treasurer, have retired from the Mesaba Electrical Company, and the business will be continued by S. R. Greenthal, who has assumed the interest of the retiring partners. C.

MAMMOTH SPRINGS, ARK.—Napoleon Hill, of Memphis, has installed an electric-light and power plant, furnishing Mammoth Springs and Thayer, Mo., with day and night service. It is said the line will be extended to Koshkonong and West Plains, Mo., and Hardy and Salem, Ark.

ALTOONA, PA.—Hollidaysburg is to have a new electric-light company, an application for a charter having been made to the governor of the commonwealth by a number of prominent local capitalists. It will be known officially as the Juniata Electric Light, Heat and Power Company.

ZACATECAS, MEX.—Robt. H. Towne, president of the Soubrette Mining Company, of this place, gives out that the company has completed extensive surveys and investigations along the Durango River and will put in a power plant to furnish power for the mines and reduction works in this locality.

CHEWELAH, WASH.—The Ione Water and Power Company has been incorporated here with a capital stock of $50,000. Charles P. Moeser, of New York, is president; E. B. H. Hemley, of Newport, vice-president, and W. G. Murray, of Ione, treasurer. The company's immediate expenditure will be about $12,000.

TOLEDO, OHIO—The Coshocton Light and Heating Company, of Coshocton, Ohio, has issued $100,000 of six per cent preferred stock, which will be sold at par and with it will be given twenty-five per cent of common stock as a bonus. The money will be used in completing its new hydroelectric plant, the power to be derived from the state dam in the Walhonding River.

TOLEDO, OHIO—F. C. Kingsbury, who recently secured a franchise for furnishing an electric-lighting system for the city of Bucyrus, Ohio, has entered into a contract with the board of public service, whereby he is permitted to purchase the present plant of the Bucyrus Electric Light Company, with the proviso that he shall install all new machinery and equipment throughout. H.

ALBEMARLE, N. C.—An election on a bond issue for electric lights and other municipal improvements was ordered in the town of Albemarle recently, the population being about 5,000. The proposed issue is for $67,000. The bond issue was voted favorably by a vote of overwhelming ratio against the opponents of the bonds, and the town is thus assured of a modern electric-lighting plant. L.

MONTEZUMA, COLO.—The Silver Princess Mining Company (formerly known as the Silver King) has just completed the installation of its electrical dynamo, air compressor, two air drills and two stoping machines, and electrical power was turned on by the Summit Power Company last week. The company expects to very materially increase the output since the electrical power has been supplied.

MARQUETTE, MICH.—Marquette's municipal-owned lighting and power plant, which has been earning large profits for the city for a decade or more from the sale of light and power to private consumers, is producing power so cheaply that the Marquette Street Railway Company has asked the City Commission if it would entertain a proposition to furnish power for the operation of the street-car system.

ANTIGO, WIS.—The Antigo Electric Company let the contract for the installation of the electrical apparatus in its new plant to the Westinghouse Company, and for the new engine to the Norberg Manufacturing Company. The plant will include two generators, 250 and 150 kilowatts, respectively, a switchboard costing $3,600, and a 250-horsepower Norberg tandem, compound condensing, high and low pressure, engine. C.

PETERSBURG, VA.—It was announced that in pursuance to a resolution of the directors a meeting of the stockholders of the Virginia Electric Tool and Manufacturing Company is to be held in Petersburg, for the purpose of considering a plan to dissolve the old company and organize a new one with capital of $1,000,000 to carry on a greatly enlarged business, under the

name of the American Electric Tool Company. The stockholders of the old company were, it is understood, to receive a good share of the stock of the new company in exchange for stock held in the former concern, provided the dissolution programme be carried out. L.

NORWICH, N. Y.—F. W. Somers of Ithaca, general manager of the Norwich Gas and Electric Company, has approved the plans for extensive repairs and improvements at the gas and electric plants of the company. In all about $43,000 will be spent. Practically four miles of new gas mains will be laid. In the electric department a 150-kilowatt generator will be installed and also a 200-horsepower engine.

NEW RICHMOND, WIS.—At the annual meeting of the Apple River Power Company Homer W. McCoy, of Chicago, was elected president; M. P. McNally, of New Richmond, vice-president, and E. P. Manwarring, of Stillwater, Minn., secretary-treasurer. This company, which has taken over the Washington County Light and Power Company, of Stillwater, Minn., will expend $210,000 in extensions and betterments. C.

CHESTER, S. C.—The Southern Power Company is making ready to develop the waterpower at Gettys Shoals, on the Catawba River, twelve miles above Camden and twenty-five miles south of Great Falls, where another large development is being finished up. The Gettys plant will give 100,000 horsepower, it is estimated, while the dam will be over 100 feet high, it is stated, with backwater running twenty miles up the river. L.

SAVANNAH, GA.—The Twin City Power Company, holding a franchise to build a dam and construct an electric plant on the Savannah River at Augusta, has applied to the city of Savannah and Mayor Tiedeman for a franchise to sell power in Savannah. The power company was represented by Judge Joseph R. Lamar and two officers of the Twin City Company. It is expected that similar franchises will be asked of numerous other cities and towns in the state of Georgia. L.

COLUMBIA, N. J.—The contract for the construction of a hydroelectric development across Paulin's Kill, Columbia, N. J., for the Warren County Power Company, Meikleham & Dinsmore, engineers, has been awarded to Frank B. Gilbreth, 60 Broadway, New York city. This contract includes the construction of a Ransom hollow dam thirty feet high and 350 feet long, as designed by Ransom & Hoadley, of Providence, R. I., a reinforced concrete power house and a tailrace, etc.

WADESBORO, N. C.—Simultaneously, almost, with the announcement of the sale of the Rockingham Power Company's plant, following long litigation for control, and winding up in a receivership and sale to parties who will spend large sums in completing the same, comes the announcement that a million-dollar cotton mill will be organized and built at once at Rockingham, some sixty-five miles southeast of Charlotte, by W. B. Cole, William Entwhistle and associates, the concern to be operated by electricity. L.

ESMERALDA COUNTY, NEVADA—The Walker River Electric Power Company, headed by George P. Costigan and Dr. A. L. Pollard, of Denver, which recently purchased water rights in Esmeralda County, Nevada, is making preliminary arrangements for the installation of a waterpower plant for the generation of electric power, the intention being to supply mine operators at Sweetwater and Lucky Boy, and other mining camps, with power for mine and mill purposes. The plant will be established on East Walker River.

PROVIDENCE, R. I.—After fifteen years of continued defeat at the hands of the farmers, the villagers of North Smithfield have voted to instruct the Town Council to enter into a one-year contract with the Woonsocket Electric Machine and Power Company for the installing of street electric lights in the town. They appropriated $12,000 for the purpose. The vote calls for lights all night, every night, for one year in Union village, Branch village, Forestdale, Slatersville, Waterford and Daly Hole, at locations to be designated by the Town Council.

BOSTON, MASS.—The Board of Gas and Electric Light Commissioners has given its approval to a consolidation of the Cohasset Electric Company with the Electric Light and Power Company, of Abington and Rockland. Under the terms of the consolidation, the latter company is to pay $18,000 for the property of the former, and to assume all of its debts. The board finds that facilities for furnishing light, heat and power will not be diminished by the consolidation, and decides that the consolidation under the terms agreed upon is consistent with the public interest.

SAN FRANCISCO, CAL.—It is given out here that a formal contract has been signed by representatives of the Truckee River General Electric Company and the reclamation service of the government fixing the respective rights of the two parties in the waters of Lake Tahoe and the Truckee River. Under this agreement the Truckee River General Electric Company relinquishes control of the Truckee River outlet to the lake to the government, and the federal government on its part grants to the company a right for a power site in the Truckee-Tahoe watershed. The government is to pay one-half of the cost of building a new dam across the Truckee River and to pay the entire cost of maintaining and operating this for irrigation purposes. It is supposed that the settling of the differences between the Reclamation Service and the power company will be followed by active work on the part of the latter.

HICKORY, N. C.—After some delay in perfecting details, it is now announced that all of the capital stock has been taken in the hydroelectric waterpower development on the Catawba River, near Hickory, in which Colonel Thornton, of Hickory, is a principal promoter. A six-million-dollar cotton-mill plant will be erected and will use power from the proposed plant, besides other industries. Although this plant has been discussed for some time, it seems very likely now that the financing of the project is fully assured and that the details will be worked out in a short while and work begun. L.

DANVILLE, ILL.—Active work looking to the harnessing of the Vermilion River for use in developing electrical power has been started. The principal dam and plant will be located midway between the C. & E. I., Grape Creek division bridge over the river and the Grape Creek interurban bridge, 800 feet north of the former. Chicago electrical men are behind the project. No bonus will be asked from the city or business men, no lots will be sold or any other catch propositions handled. The plant will be built, the power developed and sold, the price asked to be as low as can be and make a fair return to the investors.

SUPERIOR, WIS.—At the annual meeting of the Superior Water, Light and Power Company, held Thursday, August 5, the following officers and directors were elected: William R. Merriam, president; Robert R. Dunn, St. Paul, vice-president; V. M. Watkins, St. Paul, treasurer; W. H. Winslow, Superior, secretary and general manager. The following board of directors was chosen: Charles A. Chase, Superior; Kenneth Clark, St. Paul, Minn.; Robert R. Dunn, St. Paul, Minn.; William R. Merriam, Washington, D. C.; Frank A. Ross, Superior; V. M. Watkins, St. Paul, Minn.; P. G. Stratton, Superior; Thomas B. Scott, Burkeville, Va.; W. H. Winslow, Superior.

PITTSFIELD, MASS.—At a meeting of the stockholders of the Pittsfield Electric Company the following officers were re-elected: President and treasurer, Alexander Kennedy; clerk, William L. Adam; directors, W. L. Adam, S. G. Colt, Alexander Kennedy, James W. Hull, Charles E. Merrill, Henry R. Peirson and A. H. Rice. The treasurer's report showed an increase in business of 18.6 per cent over the previous year, the gross revenue of all classes of service being $142,175.30. A dividend of eight per cent was declared for the year. Reports showed that the company maintains 222 miles of overhead wires in the city and is installing three miles of underground mains in the business section this year.

PITTSBURG, PA.—Stockholders of the Philadelphia Company have voted to increase the indebtedness of the company $5,000,000 and to increase the capital stock from $42,000,000 to $47,000,600. Of this amount about $2,500,000 will be used for extensions and improvements by the Pittsburg Railways Company, the Allegheny County Light Company and other subsidiary concerns of the holding company. After the proposed improvements had been outlined by the directors 578,839 shares of stock were voted for the increase and 1,114 against. Of the issue of 5,000 debentures each has a par value of $1,000, bearing five per cent interest and maturing in ten years. They are convertible at the option of the holders into common stock on the basis of twenty shares for each debenture.

SPARTANBURG, S. C.—Following the announcement that the Electric Development and Power Company was interested in an extensive interurban trolley proposition, it is further reported that the company is now negotiating for the purchase and development of another hydroelectric site which will be bought in and developed. The company has withheld the details of the reported plan since some of the details of the scheme are not yet worked out fully. This company is carrying out extensive plans in the Spartanburg section, in which several hundred cotton mills are located, and this field is an important one, the Southern Power Company being the only competitor in one part of the field that is covered by the Electric Development and Power Company. The number of mills is rapidly increasing. L.

CHARLOTTE, N. C.—C. A. Hunt, C. A. Hunt, Jr., and W. E. Holt, Jr., of Lexington, N. C., have been in conference with the officials of the Southern Power Company in regard to buying electric power for the Winnonah, Nakomis and Dacotah cotton mills at that place. Contracts have been signed for something like 2,000 horsepower to be furnished to these mills at Lexington. The steam power will be discarded entirely, and as soon as the electric equipment can be properly installed the mills will run in the future by the hydroelectric power furnished by the Southern Power Company. Orders have already been placed by the mills for the electric motors and their necessary machinery, and as soon as the equipment is ready the Southern Power Company will be ready to furnish the power required.

ELECTRIC RAILWAYS.

(Special Correspondence.)

MAYFIELD, CAL.—The Peninsular Railway Company has applied for a franchise for an electric road in this place.

SAN FRANCISCO, CAL.—The United Railroads of San Francisco will relay its Fillmore Street line, in this city, with 141-pound steel rails.

CEDAR RAPIDS, IOWA—The Cedar Rapids and Iowa City Interurban Company has let contracts for enlargements and additions to its plant aggregating $125,000. C.

SCOTTSBURG, IND.—Scott County has voted a subsidy of $43,000 in aid of the construction of a traction road from Scottsburg to Cincinnati, by way of Madison. S.

STERLING, ILL.—It is stated that the Aurora, Joliet & Eastern Electric Railway Company will extend its line to the Mississippi River by the way of Sterling. C.

CORPUS CHRISTI, TEX.—Daniel Hewitt, of Saline, Kan., has been granted a franchise by the City Council of Corpus Christi for the construction of an electric street-railway system.

TACOMA, WASH.—The Stone & Webster interests here have secured a franchise for the extension of the Stillacoom electric line through Salter's Point. The survey for the extension has already been made.

WATERLOO, IOWA—The Waterloo, Cedar Falls & Northern will spend $500,000 on its lines in the near future. The interurban will be extended from Denver Junction to Waverly, a distance of six miles. C.

ALBANY, N. Y.—The Trackless Trolley Company, of New York city, with a capital of $150,000, has been incorporated. The directors are: Charles E. Barrett, of New York city; A. Livingston Norman and Sadie E. Wiener, of Brooklyn.

FRESNO, CAL.—The Board of Supervisors of this county has granted F. S. Granger a franchise for the connecting links across the county roads for his proposed electric railway between this place and Hanford. It is stipulated that work must begin within ninety days.

PARIS, TEX.—It is stated that the control of the Paris Transit Company, the local street-car system, had passed into the hands of a St. Louis trust company and that considerable improvements and extension to suburban property owned by the trust company would be made.

CARMI, ILL.—An electric railway is to be built from Carmi to Fairfield. The survey will be taken in a few days, and the line will be built for both passengers and freight traffic. Kansas City (Mo.) capitalists are financing the road, which will ultimately connect with the Evansville (Ind.) line.

MONMOUTH, ILL.—The Rock Island Southern interurban line has been completed to the Edwards River and the entire road will be in operation to Rock Island by January 1, 1910. Orders for eleven passenger electric cars, two Baldwin locomotives and other equipment have been placed in the East. C.

ROCK ISLAND, ILL.—A deal has been closed whereby the Rock Island Southern will get into Aledo, as the latter city has long wished. The road will build a spur from near Gilchrist to Aledo. The officials formerly asked a subscription of $100,000 from Aledo citizens, but it is understood this sum was reduced.

TRENTON, N. J.—Articles of incorporation have been filed for the Montana, Wyoming & Southern Railroad Company, Jersey City, with a capital of $5,500,000. The incorporators are Frank S. Gannon, William C. Langley and William H. Seibert. The company is to operate railroads, tramways and terminals.

BLUFFTON, IND.—The directors of the Bluffton, Geneva & Celina Traction Company have contracted with the General Electric Company for four gasoline motor cars, to be used on the road now building between the cities named. The company has decided to use motors cars until such time as the power house and overhead work is completed. S.

INDIANAPOLIS, IND.—The Vincennes Citizens' Street Railway Company, now known as the Vincennes Traction and Light Company, has filed with the secretary of state notice of the increase of the capital stock of the company to $350,000. The increase in the capital stock of the company was made necessary by the numerous improvements to track and buildings now being made or contemplated by the company.

MILLINOCKET, ME.—According to Boston advices received here the first 1,200-volt direct-current electric railroad system in New England will be between Presque Isle and Washburn, Me., with an ultimate additional extension of 110 miles north to St. John River. The Aroostook Valley Railroad, affiliated with the Canadian Pacific Railroad, are the promoters. By virtue of a law conferring monopoly within its territory, the Bangor & Aroostook Railroad is protected from invasion by a steam railroad, therefore the new road will be built for electric operation, both passenger and freight. Its voltage will be the same as the New York Central road's voltage through the Park Avenue tunnel. Power will be purchased, according to the plans, from the Maine and New Brunswick Power Company, at Aroostook Falls. On the south the new road will connect with the Canadian Pacific.

ZANESVILLE, O.—B. E. Ottman, treasurer of the Cleveland, Barberton, Coshocton and Zanesville Interurban, has announced that construction on the new road would commence some time in August. One force of workmen will work from this city north and one from Coshocton south. The road at this end of the line will be finished first.

GRAND RAPIDS, MICH.—The Michigan & Chicago Westbound Railway Company, capitalized at $3,000,000, has filed incorporation papers at Lansing. This is believed to be the interurban from Grand Rapids to Kalamazoo, through Allegan and Barry counties, in the promotion of which W. P. Jacobs, of Kalamazoo, has been working for several years.

EVANSVILLE, IND.—The strike on the Evansville & Southern Indiana Traction Company's local division by carmen has been declared off, the forty men which the company agreed to re-employ have been assigned to work at the old rate of wages and the company maintains an open shop. The men were out ten weeks and failed to gain a single point. S.

SAN JOSE, CAL.—The Peninsular Railway Company, under which name are consolidated the old Peninsular Railroad Company, the San Jose-Los Gatos Interurban Railway Company and the Santa Clara Interurban Railway Company, has filed its articles of incorporation here. The company will operate, when the projected extensions are completed, 222.2 miles of electric road.

BELLEVILLE, ILL.—Work on the East St. Louis, Columbia and Waterloo Electric Railway is being pushed so as to have the road in operation by November 1. Condemnation suits have been filed in the County Court. President E. F. Schoenning and Secretary-Tresurer H. Reichenbach, of Waterloo, declare that the road will be completed and ready for passengers by November 1.

PEORIA, ILL.—The Peoria Railway Company will lay new rails on the upper part of Adams Street, a distance of about two miles, as soon as the summer rush is over. The company will use the heavy girder rail, as with the new double-truck cars the rails now in are too light. This company has just placed an order for a number of pay-as-you-enter cars for the Adams Street line. V.

BISBEE, ARIZ.—Recently in Washington, D. C., the secretary of the interior decided in favor of the Cochise County Electric Company and against the Arizona Southern Company, in the case long drawn out for the right-of-way over the abandoned E. P. & S. W. grade from French through the pass by Cochise. The former company will now build its electric line from Bisbee to Douglass.

DES MOINES, IA.—It is stated that Congressman McKinley, head of the Illinois Traction system, will spend $500,000 on new tracks, new cars and better service when he takes over the Des Moines City Railway Company. Mr. McKinley has been making a thorough inspection of the lines, though the actual fact of purchase or details connected with it have not as yet been announced.

BRISTOL, CONN.—The Meriden, Middletown and Guilford Electric Railway has been organized in Meriden with $50,000 capital. Ex-Senator Francis Atwater is president. The stock has all been taken up by the incorporators. Work will begin at once. When completed the road will give direct connection to the shore and run through a prosperous and picturesque section of the state.

ROCKLAND, ME.—Another link in Maine trolley line construction destined to traverse the entire length of the Penobscot Valley will be built between Camden and Belfast. The charter is held by the Waldo Street Railway, some of the directors of which are also identified with the Rockland, Thomaston & Camden Street Railway. The latter corporation is not concerned in the project, however.

IOLA, KAN.—It is stated at Coffeyville that the Kansas Union Traction Company, of which W. J. Jones, of Altamont, is president, is going to make that city the starting point for a line to Columbus, Kan. It will run through Mound Valley, Oswego, Hollowell and Sherwin. At the same time it is announced that the company will build from Coffeyville to Parsons by way of Altamont.

PENDLETON, ORE.—Articles of incorporation have been filed for the Farmers' Railway and Navigation Company, which proposes to build and operate an electric railroad system in Umatilla County. The first unit will be a road between the towns of Umatilla, on the Columbia and Milton, in the heart of the fruit and grain belt of the east end of the county. The company behind the scheme is incorporated for $250,000, and it is announced that surveyors are already in the field prepared to locate the right-of-way. The capital stock of the Farmers' Railroad and Navigation Company is divided into 2,500 shares, of

$100 each. In addition to the main line of electric road from the Columbia to the center of the wheat belt, articles of incorporation also permit branch lines, the maintenance of a fleet of steamers on the Columbia, and construction of telegraph and telephone lines.

AUBURN, ME.—Directors of the Portland, Gray and Lewiston Electric Railroad have raised the necessary capital to build the road. A large number of changes have been made in its location since the original survey. It will be practically a straight line from Main and Lisbon streets in Lewiston to Monument Square in Portland. W. S. Libbey, of Lewiston, has been elected treasurer.

WHEELING, W. VA.—It is stated that the proposed electric line between Marietta and Wheeling is not to be a trolley line, but an electric railroad, equipped with electric locomotives for the hauling of freight and passenger trains. The right-of-way men have been working between Marietta and Newport and have secured some of the desired privileges and are now waiting until the engineer arrives in order to make some suggested changes in the survey.

ERIE. PA.—Notice was given in court last week that Attorneys Gunnison, Rilling and Fish, acting as attorney for the Erie, Cambridge, Union & Corry Railway Company, have given their consent to the decree of the court directing the sheriff to sell the Erie, Cambridge, Union & Corry Railway Company to satisfy the creditors. The sale was brought about at the suit of the Erie Trust Company, successors to the New York Security and Trust Company.

SAN FRANCISCO, CAL.—The Board of Supervisors has adopted the recommendation of the Public Utilities Committee favoring the re-submission of the proposition of issuing bonds for the construction of a municipal electric railway on Geary Street in this city. The proposition will be submitted in December. The proposition was lost by a few hundred votes a few weeks ago, notwithstanding the fact that a considerable majority of the votes cast were in favor of it.

PETERSBURG, VA.—As required by law, the charter of the newly organized or reorganized properties, under the title of the Virginia Railway and Power Company, having been granted, and a mortgage deed given in favor of the Equitable Trust Company of New York to secure a fifteen-million-dollar first and refunding mortgage bond issue of five per cent gold bonds, this mortgage has been filed with the court here to be copied. It is a lengthy manuscript of some 125 pages of printed matter. L.

SOUTH BEND, IND.—The South Shore traction railroad has acceded to the demands of its trainmen and increased their pay from 23 to 27½ cents an hour. This agreement is significant, because it is the first instance known where an agreement was entered into between an electric company and the steam-railway unions. General Manager Wallace says the arrangement will assure the company experienced trainmen in its service, because the Steam Trainmen's Union requires a two years' apprenticeship. S.

QUINCY, ILL.—The city of Quincy, Ill., is asking the Illinois Traction Company, which owns the local street railway, to build an interurban from Quincy as the price of the extension of the local franchise. A committee will wait upon General Manager Chubbuck to ask the company to accede to their demands. They are not particular as to what direction the road goes, but they will ask for a line to Peoria, Springfield, to East St. Louis via Roodhouse, to Galesburg, and from Quincy to Carthage, Nauvoo and Fort Madison. V.

AUGUSTA, ME.—The Board of Railroad Commissioners have rendered a decision approving the amended petition of the Portland, Gray & Lewiston Railroad Company to operate an electric line between Auburn and Portland through the towns of New Gloucester, Gray, Cumberland and Falmouth. The amended petition provided for a different route for the road so as to get rid of telephone poles along the line. This railroad has been in the public eye of late because of litigation among its promoters over the stock of the company.

ASHEVILLE, N. C.—Provision has been made by the Asheville Electric Company, by a bond issue, for the raising of three-and-one-half million dollars for improvements whenever such shall be decided upon by this thriving company. The electric company has made a mortgage deed to the Old Colony Trust Company, trustee, for the three-and-one-half million dollars, in denominations of $1,000, payable July 1, 1939, at five per cent interest. The mortgage given the Old Colony Company is located in Buncombe County, of which Asheville is the county seat. The city system of trolleys is known for its high degree of efficiency and successful management, and extensive improvements locally are not unlikely in the near future. L.

DALLAS, TEX.—Texas Traction is doing well. The increase in earnings is averaging thirty-six per cent over last year. June 30 ended the road's first year of operation of the Dallas-Sherman line. In that twelve months passenger receipts at various stations were shown as follows: Dallas, $52,162.75; Richardson, $5,125.75; Plano, $20,025.15; Allen, $7,248.95; McKinney, $39,690.96; Melissa, $5,698.69; Anna, $5,675.20; Van Alstyne, $14,644.80; Howe, $7,036.75; conductors, $50,305.10; gross total, $244,780.08; redemptions, $368.72; net passenger, $244,411.28; express, etc., $13,904.61; total, all, $263,315.89. As the express business started in September only, the total is regarded as excellent, in view of the fact that the first month showed about $600 and June made it $2,949.81 and July promises much better.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

BUCHANAN, N. D.—A telephone company is being organized by Edward Isaacs and others.

NASHWAUK, MINN.—The Mesaba Telephone Company is preparing to put in a central here.

GILMER, TEX.—The Gilmer Telephone Company has been incorporated in this place with a capital of $10,000.

FORDYCE, ARK.—The Southern Telephone Company has been incorporated with a capital stock of $1,000,000.

CEDAR RAPIDS, IOWA—The Cedar Rapids & Iowa City Interurban Company has let the contract for additions to its plant, to cost $150,000.

MARSHALLTOWN, IOWA—The Farmers' and Merchants' Telephone Company is about to begin construction of a plant here, to cost about $150,000.

WENATCHEE, WASH.—C. B. Cooper, construction engineer of the United Wireless Telegraph Company, is here to superintend the construction of a wireless station.

ST. PAUL, MINN.—The Bell Telephone companies in Minnesota, the Dakotas, Iowa and Nebraska have been merged for operating purposes, but will retain separate corporate existence with local officers.

SUMTER, S. C.—The Sumter Telephone Company is making ready to improve its Sumter system of telephones by the installation of the common battery, and by other improvements, costing about $12,000, to be put in within a few months. L.

GOUVERNEUR, N. Y.—A new telephone line is to be constructed from this village to the plant of the Uniform Telephone Company, which is now being built at Talcville. It will be a part of the Bell system. The work will be commenced immediately.

YORKVILLE, S. C.—N. C. McCorkle, with the aid of experts, is laying off the streets of Yorkville preparatory to rebuilding the local telephone system of the Piedmont Telephone Company, and laying the lines in underground cables, affording the town an up-to-date system for local use. L.

SALISBURY, N. C.—A recent report here is to the effect that application has been made of the town for a franchise by outside parties to locate a number of telephone booths in the town, though it is not known who is behind the movement at this time. At present the Bell Telephone controls the field. L.

ENOREE, S. C.—The Enoree Telephone Company has made application for the right to increase its rates for telephones, and the railroad commission has sent the company a copy of its thirtieth report, prescribing the necessary methods of procedure where such a step is contemplated in South Carolina. L.

LITTLE ROCK, ARK.—Articles of incorporation have been filed with the secretary of state by the Southern Telephone Company, capital stock $1,000,000, of which $233,000 has been subscribed, incorporated to do a general telephone business. The company will have its offices at Fordyce. The incorporators are A. B. Banks, J. W. Lee, H. C. Couch, H. A. Longino, C. B. Lyle and T. A. Monroe.

SAN FRANCISCO, CAL.—The United States Circuit Court of Appeals, in the case of the Sunset Telephone and Telegraph Company vs. the City of Pomona, Cal., has decided that any telegraph or telephone company doing an interstate business may establish its lines in any city or state without a franchise, being subject only to a police power concerning where such poles and wires may be placed.

FLINT, MICH.—Flint is to have a $100,000 telephone exchange. B. W. Trafford, vice-president and general manager of the Michigan State Telephone Company, was in this city Thursday afternoon and announced that bigger quarters are necessary for the business. Ground has been purchased in the heart of the business district and a two-story brick building, to be sixty feet square, will be completed by the first of the year.

TOLEDO, OHIO—The Central Union Telephone Company has begun mammoth improvements at Dayton, where they will expend about $200,000. The work will consist of a new branch exchange building, two stories high, with commodious lunch and rest rooms, lavatories, club room, kitchen, supply rooms, and elaborate equipment. The Rouzer Company has been awarded the general

contract and the work will be completed by October 1. Numerous underground connections are necessitated, adding materially to the expense. The company announces that two additional exchanges will probably be installed next year. The system when completed will be one of the most complete in the entire country. H.

HOUSTON, TEX.—Prominent among the proposed new buildings here will be that of the Southwestern Telegraph and Telephone Company. This will be the new station in South End. According to District Manager Pike, it will not be less than four stories, built of concrete. Work will commence on it within the next month or six weeks, as the company must occupy a portion of it by November 1. It will not cost less than $60,000.

TOLEDO, OHIO—During the rush hours Monday of last week the entire force of girl operators at the office of the Home Telephone Company, of Napoleon, Ohio, went out on strike, leaving the manager in sole charge of 700 telephones. Without previous warning the girls demanded weekly pay and an advance of salary. The time of payment was conceded, but the advance denied. The vacant places have been filled by help from Toledo and Detroit. H.

RICHMOND, VA.—An important farmers' telephone line will soon be connected with the telephone exchange of the Southern Bell Telephone Company in Richmond. The line will extend about five-and-one-half miles from Richmond, in Chesterfield County, and will connect with the Southern Bell Telephone Company. There are a number of farmers' telephone lines in Chesterfield County already, and the progressive farmers are in close touch with their friends and neighbors.

SPRINGFIELD, MASS.—Branch offices have been established by the New England Telephone and Telegraph Company at a half-dozen different places in Springfield and vicinity for the convenience of subscribers who desire to pay their bills in person, and who do not wish to go to the central office. The company officials say they believe this plan of establishing branch agencies will not only be of convenience to subscribers, but will be advantageous to the company by securing prompter payments.

DES MOINES, IOWA—It is stated that a radical change in the managerial policy of the Iowa (Bell) Telephone Company will shortly be inaugurated. In general the new arrangement contemplates the doing away with a large number of managers of local exchanges. In lieu of a manager in each town the state will be divided into districts, with a general manager in charge of each district. Just how many districts will be comprised within the border lines of Iowa is still to be decided. It furthermore is reported from Des Moines that among the men to be favored with the new managerial position local Manager F. D. Cleaver, of Dubuque, will be assigned to a post.

HARTFORD, CONN.—The action of the state Senate in passing the bill authorizing savings banks to hold first-mortgage bonds of the Southern New England Telephone Company is considered a common sense proceeding. The company has a long record of prosperity, is recognized as managed with keen business ability, and never misses a dividend. Its bonds should be as safe as those of any other latter-day public service corporation. It is unfortunate that the state has to pass special laws for the government of savings bank investments. Such legislation is taken as an order to buy. In fact, it is at most merely permissive. The officials of the institution may buy these, if they deem best; they are not compelled to do so. In the case of the Southern New England bonds there is so little element of risk that it is surprising that there was any objection.

NEW MANUFACTURING COMPANIES.

(Special Correspondence.)

INDIANAPOLIS, IND.—Wood Electric and Manufacturing Company, South Bend, has given notice of increase of capital from $10,000 to $30,000.

MUNCIE, IND.—The Warner Electric Company has incorporated, with a capital of $100,000, for the purpose of establishing and equipping a plant for the manufacture and sale of electrical machinery and supplies. W. E. Hitchcock, R. C. Stone, A. L. Johnson and C. E. Davis, directors. S.

COLUMBUS, OHIO—The Electric Supply Company, of Columbus, was incorporated last week with a capital stock of $50,000, for the manufacture of electrical, gas and steam supplies and other merchandise. The incorporators are E. W. Swisher, L. M. Ferguson, J. D. Price, C. E. Myers and Ferdinand Baumann.

NEW YORK, N. Y.—The Traction Materials Company, of New York, has been incorporated to manufacture and deal in electrical and mechanical apparatus, material, appliances, etc., machinery and supplies. Incorporators: Adolph Schneider, 1834 Catin Avenue, Brooklyn; George W. Meacham, 126 Riverside Drive; John G. Bishop, 87 Madison Avenue, both of New York. The capital stock is reported to be quite small, though it may be merely nominal.

ELECTRICAL SECURITIES.

The bulls are still in control of the market and electrical securities in common with industrials generally hold their strength. The placing of large orders by equipment companies has shown the absolute strength of the position of United States Steel. The market is intrinsically sound, but prices are now running to a level where some setback may be expected, as speculators have about discounted conditions, and it will be some while before transactions broaden sufficiently to carry prices much higher.

DIVIDENDS.

Mobile Electric Company have declared a quarterly dividend of one-and-one-half per cent on the preferred stock of the company, payable August 16, 1909, to stockholders of record August 14, 1909.

Directors of the Northern Texas Electric Company have declared the regular semi-annual dividend of three per cent on the non-cumulative preferred stock, and an initial dividend of two per cent on the common stock of the company. Both dividends are payable September 1 to stock of record August 30, 1909.

NEW YORK.

	Aug. 16.	Aug. 9.
Allis-Chalmers common	15⅛	15¾
Allis-Chalmers preferred	53⅞	56¼
Amalgamated Copper	86½	85⅝
American Tel. & Cable	80*	80*
American Tel. & Tel.	141⅝	142½
Brooklyn Rapid Transit	80¼	80½
General Electric	169⅝	171¾
Interborough-Metropolitan common	14½	15½
Interborough-Metropolitan preferred	47¾	48½
Kings County Electric	135	....
Mackay Companies (Postal Telegraph and Cables) common	81	82½
Mackay Companies (Postal Telegraph and Cables) preferred	74½	74⅝
Manhattan Elevated	143½	144⅝
Metropolitan Street Railway	20	....
New York & New Jersey Telephone	143	142
U. S. Steel common	78½	77⅜
U. S. Steel preferred	127	126¾
Western Union	74	75½
Westinghouse common	87⅛	88¾
Westinghouse preferred	120	....

*Last price quoted.

BOSTON.

	Aug. 16.	Aug. 9.
American Tel. & Tel.	141⅝	142¾
Edison Elec. Illuminating	254	....
General Electric	169⅝	....
Massachusetts Electric common	13	13
Massachusetts Electric preferred	73	74½
New England Telephone	137	....
Western Tel. & Tel. common	11⅛	....
Western Tel. & Tel. preferred	90	90

PHILADELPHIA.

	Aug. 16.	Aug. 9.
American Railways	45⅞	47
Electric Company of America	12¼	12½
Electric Storage Battery common	61	61¾
Electric Storage Battery preferred	61	61¾
Philadelphia Electric	12⅜	12½
Philadelphia Rapid Transit	30¼	31⅝
Philadelphia Traction	91	91¼
Union Traction	54⅝	55⅜

CHICAGO.

	Aug. 16.	Aug. 9.
Chicago Railways, Series 1	108	112
Chicago Railways, Series 2	38⅛	39
Chicago Subway	20½	23½
Chicago Telephone	135½	135
Commonwealth Edison	121	120⅛
Metropolitan Elevated common	17¾	....
Metropolitan Elevated preferred	49	50
National Carbon common	99	98
National Carbon preferred	119	120

PERSONAL MENTION.

E. E. KESTER, of Greenville, Ohio, has been appointed by H. E. Roseman, general traffic manager of the Illinois Traction system, to succeed S. K. Holland as division traffic manager at Peoria, with the title of general agent. V.

S. K. HOLLAND, division traffic manager for the Illinois Traction Company at Peoria ever since the company has been running into that city, has resigned. Mr. Holland will ally himself with the Peoria and Galesburg Interurban and will hold a position close to President Stephens, who was formerly with the Traction Company. V.

PUTNAM A. BATES, specialist in electrical and mechanical equipments and, among other works, designer of the heating, lighting and power plant of the Engineers' Club Building of New York, has removed from his offices in Broadway to occupy more commodious quarters in the top floor of the United States Express Building, 2 Rector Street, New York city.

J. J. BROWN, M. Am. Soc. M. E., was elected vice-president and general manager of the Wheeler Condenser and Engineering Company, at the recent annual stockholders' meeting, held at the company's works at Carteret, N. J. Mr. Brown entered the condenser field some fifteen years ago as southwestern manager for the Henry R. Worthington Company, and later became general

sales manager. After the formation of the International Steam Pump Company he became their western general sales manager, with headquarters at Chicago, and resigned that position to take up his present work.

C. A. PINYERD, traveling electrician of the train-lighting department of the 'Frisco, has been spending several weeks in the analytical department of the chemical department of Armour Institute of Technology, Chicago. Mr. Pinyerd will return to Chicago some time this month to accept a position in the operating department of the Safety Car Heating and Lighting Company.

CHARLES W. McDANIEL has been appointed general commercial superintendent of the Missouri & Kansas Telephone Company. Mr. McDaniel is one of the old-timers. He built the first telephone exchange in Hannibal, Mo., in 1879, and also built the Moberly exchange a little later. He then moved to Joplin, where he operated exchanges covering twenty-seven counties, equipping exchanges in Joplin, Carthage and Webb City, Mo., and at Galena, Kan. In 1883 he sold out to the Missouri & Kansas Company, which company he has been with since that time, acting just before he received the above appointment as assistant general superintendent. Other changes which have occurred in the company are W. W. Johnson, general superintendent of plant, and F. C. Penfield, general superintendent of traffic. In connection with his early experience in the telephone industry, Mr. McDaniel is proud of an autograph letter from Theodore N. Vail, now president of the American Telephone and Telegraph Company. This letter was written on March 8, 1879, when Mr. Vail was general manager of the old Bell Telephone Company, whose offices were in room 52 of the New York Mutual Life Insurance Company, Boston, Mass. At that time Gardner G. Hubbard was president and Thomas Sanders treasurer of the company. Alexander Graham Bell was electrician, and Thomas A. Watson general superintendent.

OBITUARY.

CAPTAIN HERMAN P. SCHUYLER, assistant treasurer of the General Electric Company, and one of the best-known credit men in the country, died on August 14, at his home in Albany, aged sixty-seven years. He was a direct descendant of General Schuyler of Revolutionary fame, and himself won distinction in the Civil War. In 1864 he was appointed head of the Ordnance Department with headquarters at the Watervliet Arsenal. In 1887 he became private secretary to the late H. H. Rogers, of the Standard Oil Company. He had been with the General Electric Company since 1893.

NEW PROPOSALS.

POST OFFICE AND COURT HOUSE, SAN ANGELO, TEX.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., September 16, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring and standard clock system) of the U. S. Post Office and Court House at San Angelo, Tex., in accordance with the drawings and specification, copies of which may be obtained from the custodian of site at San Angelo, Tex., or at the Supervising Architect's office.

NEW PUBLICATIONS.

YEARBOOK OF THE MICHIGAN COLLEGE OF MINES—The Michigan College of Mines, Houghton, Mich., has published its yearbook for 1908-1909 announcing the courses for 1909-1910. Besides the usual calendars, lists of officers and instructors, regulations for admission, departmental information, etc., always included in such publications, the yearbook in question contains a map of the campus, a map of the Portage Lake mining district and a number of tables giving a schedule showing the number of hours given to each subject during each week in each term and time schedules for the different terms.

ENGINEERING ASSOCIATION OF THE SOUTH; PROCEEDINGS—Vol. XX, No. 2, for April, May, June, 1909, of the quarterly publication of this association, contains the minutes of the Nashville (Tenn.) Section meetings, held on May 24 and June 21 of this year, those of the Birmingham (Ala.) Section of April 1, May 6, May 20 and June 3, and of the Atlanta (Ga.) Section, April 22, May 13 and June 10. The following papers are included: "Pavements Demanded at the Present Time by Urban and Interurban Roads," by H. L. Collier—presented June 10. "Tar-Cap Macadam," by M. Nicholson—February 4. "Water-Power Economies," by John Wilkes—March 15. "Observations on Jetty Building," by R. H. Lowndes—February 25.

INDUSTRIAL ITEMS.

THE NATIONAL POLE COMPANY, Escanaba, Mich., has just loaded two trainloads of poles at its Northern Minnesota yards for shipment to Mississippi.

THE DICKINSON MANUFACTURING COMPANY, Springfield, Mass., announces that it has registered its "Gummon" trademark in the United States and many foreign countries.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., has issued a catalogue describing with the aid of some very clear illustrations their new type of rosettes.

THE GREGORY ELECTRIC COMPANY, Chicago, Ill., has issued the August number of its monthly "Bargain Sheet" of second-hand but reliable electrical apparatus and machinery.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, Chicago, Ill., has published a complimentary pamphlet, entitled "What They Think of the Telephone in Train Dispatching," giving the opinions on this subject of prominent railroad men.

THE J. P. DEVINE COMPANY, Buffalo, N. Y., is distributing a pamphlet containing a list of over 2,000 users of their Passburg vacuum drying and impregnating apparatus. The same company has also issued some attractive motto cards suitable for hanging.

ROTH BROTHERS AND COMPANY, Chicago, Ill., have issued Bulletin 207 on Roth motors, which are ordinarily furnished shunt-wound, but compound or series-wound if desired. The same firm has also issued a blotter illustrating a feed-grinding mill geared to a Roth motor.

THE CURTIS BATTERY COMPANY, Minneapolis, Minn., has issued a pamphlet on its primary and storage batteries. A table gives the number of cells, lamp voltages, amperes per lamp, discharge rates, costs, etc., for lighting plants of given numbers of sixteen-candlepower lamps from six to 100.

THE KIMBLE ELECTRIC COMPANY, Chicago, Ill., has issued a convincing folder extolling the merits of Kimble motors. These motors are made for use on single-phase alternating-current circuits and have variable speeds from 300 to 3,000 revolutions per minute. They need no extra current to start, and will start with the full load. The motors are sold on a "money-back" offer and are guaranteed for two years.

THE EXCELLO ARC LAMP COMPANY, Chicago and New York, has just issued its latest bulletins (Nos. 101 and 102), the former on the Excello Flaming Arc Lamp, and the latter on the Duplex Excello Flaming Arc Lamp. These give detailed descriptions and explain the working and new features of the lamps, with the aid of some excellent diagrams. Bulletin 102, on the Duplex lamp, describes the mechanism and its action in great detail.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing several folders descriptive of improved wireless telegraph apparatus suitable for experimental and private installation. A complete description is given of the various sizes of receivers, detectors and sending sets. Several new types of spark and tuning coils are described which, together with complete diagrams of connections, should prove of much interest and service to those engaged in wireless telegraph work.

THE UNITED ILLUMINATING COMPANY, Bridgeport, Conn., is installing a Westinghouse 500-kilowatt steam turbine for driving a 650-kilowatt-ampere, 2,400-volt, three-phase, sixty-cycle Westinghouse alternator, which is to feed into the distribution system serving the city of Bridgeport and surrounding territory with light and power. The present installation is an addition to the existing equipment of a 300-kilowatt Westinghouse turbine driving a Westinghouse alternator, besides several small belted units.

THE WESTERN ENGINEERING COMPANY, Los Angeles, Cal., announces a successful trial of the Seabrook-Box Differential Axle, which was made over the lines of the San Bernardino Valley Traction Company on a street car fitted with the new axles. Appended to the announcement is a list of signatures of the members of the party carried in the car, who thus certified to the excellence of the differential axle in promoting a smoothness of running not hitherto attained in cars fitted with the ordinary stiff one-piece axles. The above company is the exclusive agent for the American Differential Axle Company, which has recently issued its second annual report of the directors. This report shows evidences of ultimate success of the associated companies promoting the differential axle.

THE ELECTRICAL ALLOY COMPANY, Morristown, N. J., which was formed some months ago, has now got its plant in good running order and is doing good business in the manufacture of electrical resistance alloys. The company has recently issued a pamphlet setting forth the merits and variety of its goods, which shows that it is manufacturing resistance materials in every variety of wire, sheet and ribbon, including nickel-steel, nickel-copper, ferro-nickel, nickel-chromium and german-silver

alloys, for use in all kinds of electrical apparatus. These alloys are turned out in some forty different diameters from as fine as 0.003 inch (containing 5,000 feet to the pound), and all run exactly even, to meet the most exacting requirements. H. P. Reigart is the president, and F. S. Reigart the secretary, of the company. Both are resident in Morristown.

THE UNITED ELECTRIC COMPANY, Chambersburg, Pa., has contracted with the Ball & Wood Company, Elizabethport, N. J., for two 750-kilowatt, Rateau-Smoot, high-pressure turbines and sixty-cycle, three-phase generators, to be installed in its plant at Lemoyne, Pa. The United Electric Company is owned by the Cumberland Valley Railroad Company, and the latter is, in turn, controlled by the Pennsylvania Railroad Company. The specifications for the units just contracted for were issued by the Motor Power Department of the Pennsylvania Railroad Company.

THE HOYT INSTRUMENT WORKS, Penacook, N. H., have issued an instructive catalogue on ammeters, voltmeters and volt-ammeters, for direct current. The Hoyt voltammeter for testing ignition circuits consists of a type C. 25 ammeter and voltmeter mounted on a single base and so wired into the ignition circuit that both instruments are in circuit during the whole period that the engine is running. Type 35 ammeters and voltmeters are made in two styles, C. 35 for switchboard or wall use, and P. 35 for portable use. They are furnished in various finishes. The ammeters of the first class are self-contained up to 5 amperes normally, and those of the second class up to 100 amperes. All the type 35 voltmeters are self-contained up to 150 volts. Type P. 5 instruments register up to 200 amperes, and 750 volts, respectively. Other types are described for dashboard and switchboard use, pocket use, etc.

THE GARWOOD ELECTRIC COMPANY, Garwood, N. J., announces that it has appointed the Tucker Electric Company, of 970 Old Colony Building, Chicago, as its selling agent for the city of Chicago and as far south in Illinois as a line drawn east and west through Springfield, and including Springfield, and as far in Wisconsin as a line drawn east and west through Madison, and including Madison, and that portion of Indiana north of a line drawn east and west through Indianapolis, and including Indianapolis. Mr. Tucker is very well known in the electrical field, was formerly connected with the Western Electric Company, and but recently with the International Cash Register Company. The Garwood Electric Company announces that it has appointed Fellows & Fellows, Lawler Building, Toronto, Canada, as its sales agents. Their territory includes the entire Dominion of Canada. Fellows & Fellows are very well known in railway and general engineering lines.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., reports the following among recent orders for electrical apparatus: Indiana Steel Company, Gary, Ind., seventy mill motors, totaling about 2,400 horsepower (this is an addition to the 11,000 horsepower of Crocker-Wheeler motors employed at the present time by this company); Gould Paper Company, Lyons Falls, N. Y., electric drive for paper-making machine about to be installed; J. M. Kohler Sons Company, Sheboygan, Wis., one 750-kilowatt, 250-volt, direct-current generator; King Bridge Company, Cleveland, Ohio, one 150-kilowatt, compound-wound, 250-volt generator, for supplying light and power; American Lace Manufacturing Company, Elyria, Ohio, one 100-kilowatt generator; Bethlehem Steel Company, a 225-horsepower, compound-wound motor, to be installed at the Saucon plant (this is an addition to the 8,800 horsepower of Crocker-Wheeler motors employed at the present time by this company); Beadleston & Woerz, New York city, 187 horsepower in compound-wound, 115-volt motors, and one 150-kilowatt, 125-volt, compound-wound generator; Roessler & Hasslacher Chemical Company, Perth Amboy, N. J., 295 horsepower in three-phase, sixty-cycle, 480-volt, induction motors of the squirrel-cage type.

DATES AHEAD.

Northwest Electric Light and Power Association. Annual convention and joint session with Seattle branch, A. I. E. E., Seattle, September 7-9.

Pennsylvania Electric Association. Annual convention, Eagles Mere, Pa., September 8-10.

International Association of Municipal Electricians. Annual convention, Atlantic City, N. J., September 14-16.

Kansas Gas, Water, Electric Light and Street Railway Association. Next meeting, Wichita, Kan., September 23-24.

Illuminating Engineering Society. Annual convention, New York, N. Y., September 27, 28 and 29.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

Colorado Electric Light, Power and Railway Association. Annual convention, Denver, Colo., October 7, 8 and 9.

Railway Signaling Association. Annual meeting, Louisville, Ky., October 12-14.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 and 18.

RECORD OF ELECTRICAL PATENTS.

[Issued (United States Patent Office) August 3 and 10, 1909.

929,708. SERVICE-METER SYSTEM. William Reid, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company. Filed December 5, 1907. A service meter for a telephone system has differentially wound coils.

929,744. MOTOR. Ernest E. Yaxley, Chicago, Ill. Filed December 28, 1908. Includes an electromagnet, an accumulatory power device for operating mechanism for transmitting energy to do work, a circuit-closing mechanism for the first, etc.

929,745. WIRELESS COMMUNICATION. Clifford D. Babcock, New York, N. Y., assignor to United Wireless Telegraph Company. Filed September 25, 1905. Describes a form of electrode for a radiotelegraphic liquid detector.

929,758. DYNAMO REGULATOR. Stephen D. Field, Stockbridge, Mass., assignor to Pittsfield Spark Coil Company. Filed February 14, 1908. In combination with the armature of a self-excited dynamo are an electromagnet having a number of windings, a resiliently mounted armature therefor, a storage battery, a circuit extending between the armature and the battery, and including a portion of the windings of the electromagnet and its armature, depolarizing coils on the field magnet, and means actuated by the electromagnet for cutting in and out these coils.

929,763. ELECTROMAGNETIC APPARATUS FOR ACTUATING MECHANISMS. Samuel H. Hoggson, New York, N. Y. Filed June 29, 1906. Comprises a frame, a weighted oscillating member pivotally mounted thereon, a lever pivotally mounted upon the frame, having one end pivotally secured to the oscillating member, and another end connected to an armature, a solenoid secured to the frame, a circuit-closing device, and means carried by the weighted arm for actuating the circuit-closing device near the end of the oscillations of the oscillating member.

929,773. CURRENT-LEAK INDICATOR FOR ELECTRICAL CONDUCTORS. Raymond S. Masson, Berkeley, Cal. Filed August 10, 1908. The indicator consists of an insulator whose surface is visibly changed by the action of an electrical current thereon.

929,778. COMPOUND METAL BODY AND PROCESS OF PRODUCING SAME. John F. Monnot, New York, N. Y., assignor to Duplex Metals Company, New York, N. Y. Filed April 24, 1907. Renewed June 16, 1909. The process of producing compound bodies comprising aluminum and a non-aluminous metal inseparably united, consists in contacting a body of one such metal with a supermolten mass of a third metal and then contacting the coating formed by such supermolten mass with a mass of molten aluminum and causing a layer thereof to solidify thereon.

929,844. RELAY. John Erickson, Chicago, Ill., assignor, by mesne assignments, to First Trust and Savings Bank, trustee, Chicago, Ill. Filed August 20, 1906. An armature is hung on a knife-edge bearing carried at one end of the tubular casing of an electromagnet; a sheet-metal holding device is secured to the magnet and engages the armature to removably hold the same in place on its fulcrum; and switch contacts are secured at the other end of the casing and operated by the armature.

929,854. ELECTRICAL MEASURING INSTRUMENT. Dugald C. Jackson, Madison, Wis., assignor to Dugald C. Jackson and William R. Jackson, Madison, Wis., a copartnership. Filed June 5, 1905. Renewed June 21, 1909. Associated with the circuit through a pressure field coil for a movable element connected in bridge of the line limbs of the instrument, is a transformer which co-operates with an inductance means to modify the current flow through the pressure coil to bring the current into phase with the main-line pressure.

929,878. INSULATOR. Joseph W. Ranson, Batavia, Ohio. Filed July 22, 1908. Comprises a rotatable body provided with means for receiving the wire when in one position and means for bending and automatically interlocking with the wire when rotated to a different position.

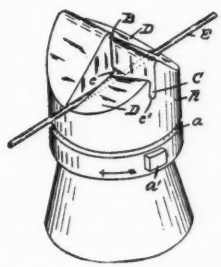
929,901. ELECTRIC HEATER. Charles E. Trewhella and Everett D. Holley, Forestville, Conn., assignors to the American Silver Company, Bristol, Conn. Filed July 17, 1907. The heat-unit-receiving member has a number of heat-distributing wings extending from it, and the heat unit is provided with an insulating block and a contact.

929,918. TROLLEY-WHEEL. Bert Crow, Findlay, Ohio. Filed August 8, 1908. The body has pivotally connected to it a harp which is mounted to swing into or out of engagement with the wheel.

929,947. ELECTRIC NEEDLE-SPRAY BATH-BRUSH. Harry Hertzberg, New York, N. Y. Filed July 5, 1902. Renewed September 10, 1903. Comprises a handle, groups of coarse and soft bristles, and means for directing the spray between either the coarse or soft bristles.

929,965. EXTENSION-CALL FOR TELEPHONES. Abner R. Marcotte, Concordia, Kan., assignor of one-half to George A. Layton, Concordia, Kan. Filed May 1, 1908. A mechanically operated closer controls the circuit, and can be locked in the open-circuit position by a latch member having at one end a rotatable forked tail-piece adapted to straddle the bell rod of the telephone call bell, this tail-piece having one fork plain, and the other formed with a cam shoulder.

929,984. MACHINE-TELEGRAPH. Guy C. Read, Davenport Station, Toronto, Ontario, Canada. Filed March 21, 1908. The printing keys are operated each by a corresponding one of a number of magnets which are energized in a predetermined



929,878.—INSULATOR.

order by contact bars controlled by a mechanism comprising a number of jointed rods having endwise movement and controllable by electric dots and dashes passing over a telegraph line.

929,995. SELECTIVE-RINGING MAGNETO-BELL. Burton W. Sweet, Cleveland, Ohio, assignor to Century Telephone Construction Company. Filed September 8, 1905. Comprises an exciting electromagnet, a sectional armature mounted to oscillate in a fixed position before its poles, a bell-tapper actuated thereby, and a screw-adjustment associated with the armature adapted to adjust the air gap between the sections of the armature and the magnet poles.

930,006. BRUSH-HOLDER FOR DYNAMO-ELECTRIC MACHINES. John E. Webster, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed September 25, 1905. Has a supporting arm having a brush-holding slot, a shaft mounted on this arm and a spiral spring comprising a number of turns of different diameters which surround the shaft, and a guide web integral with the arm and a portion of which is substantially concentric with the spring-shaft and contiguous to the outer turn of the spring.

930,007. BRUSH-HOLDER FOR DYNAMO-ELECTRIC MACHINES. John E. Webster, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 3, 1906. Renewed May 19, 1909. Insulating tubes severally closed at one end are fitted over a pair of parallel cylindrical supporting arms or projections, and thin metal caps are fitted over the insulating tubes to protect and seal the insulation.

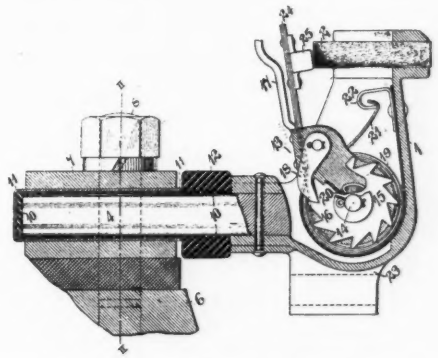
930,022. ELECTRIC POWER HAMMER. Thaddeus F. Baily, Alliance, Ohio, assignor of one-half to the Transue & Williams Company, Alliance, Ohio. Filed May 19, 1909. A number of vertically disposed series of coils are wound and connected in accordance with induction-motor construction, to act as a solenoid for the ram.

930,023. PROCESS OF STERILIZING FLUIDS. Charles B. Bartley, Pittsburg, Pa. Filed August 5, 1908. The process consists in establishing a direct current through the medium to be sterilized between immersed current terminals and simultaneously inducing a disruptive discharge through the medium and the atmosphere between an immersed terminal and an outer terminal.

930,065. ELECTRIC STORAGE BATTERY. Bruce Ford, Philadelphia, Pa. Filed September 7, 1906. An invertible battery jar is subdivided into intercommunicating superposed overflow and plate compartments and provided with oppositely arranged vent tubes communicating with the overflow compartment and respectively with the plate compartment and with the outside of the jar, and whereof the latter extends into the overflow compartment beyond the possible level of liquid therein when the jar is inverted.

930,067. COMMUTATOR BRUSH. Frank W. Garrett, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 3, 1906. The brush has an end cavity and a slot in one corner, and a cap plate has a portion that projects into the slot and a resilient stud that projects into the cavity.

930,068. BRUSH-HOLDER FOR DYNAMO-ELECTRIC MACHINES. Frank W. Garrett, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed May 21, 1906. In combination with a brush and a holder having a loop, is a shunt connector having one end attached to the brush and having a hook at its other end. A spring holds the hook in engagement with the loop.



930,007.—BRUSH-HOLDER FOR DYNAMO-ELECTRIC MACHINES.

930,100. TELEPHONE SLUG-HOLDER. Michael J. Stark, Jr., Chicago, Ill., assignor of one-half to Caspar B. Knudsen, Chicago, Ill. Filed June 27, 1908. A blank for the coin-tube consists of a substantially rectangular portion having at both ends U-shaped central extensions and centrally projecting lugs, the blank being adapted to be formed into a longitudinally open tube and the U-shaped extensions forming bottoms and covers for the tubes, there being a U-shaped excision in one of the extensions.

930,150. AUTOMATIC CUT-OFF FOR TROLLEY LINES. Robert Brown, Windber, Pa. Filed September 16, 1908. A circuit-breaker for electric conductors comprises conductor wires, a plate of non-conducting material, the ends of this plate being secured to the conductor wires, a lever pivotally secured intermediate of its ends to the plate of non-conducting material, one end of the lever always in contact with the conductor wire at the end of the plate and adapted to swing into and out of contact with the wire at the other end of the plate.

930,155. CIRCUIT-BREAKER. Herbert W. Cheney, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed October 22, 1906. A multipole switch or circuit-breaker comprises a frame or casting, an insulating support, sets of stationary contacts, in line, carried thereby, contact rods connected to the contacts, and passing through both insulating support and frame or casting at points which are staggered or out of alinement so that long leakage surfaces are provided.

930,156. OIL-SWITCH. Herbert W. Cheney, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed October 22, 1906. The oil tank is detachably secured to the frame.

930,177. ELECTROMAGNET. David J. Hauss, Aurora, Ind. Filed September 2, 1908. A core of magnetic material has a non-magnetic disk attached to one end, and a magnetic disk at-

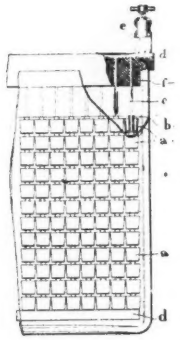
tached to the opposite end; a coil of insulated wire encircles the core, and a tubular housing of magnetic material recessed upon the interior receives the disks and forms a shoulder against which the disk of magnetic materials seats and is locked when the parts are assembled.

930,196. TIMER. Alvaro S. Krotz, Chicago, Ill. Filed February 28, 1907. The distributing member is a lateral stem carried by an arbor; a casing carries a series of contacts, each of which comprises a supporting stem carried by the casing; and a contact disk having a larger bore than its supporting stem provides a tilting as well as a lateral movement of the disk.

930,203. ELECTRICAL INSTRUMENT FOR PYROGRAVURE AND SURGICAL PURPOSES. Louis Mandarelli, Paris, France, assignor to Paul Berville, Paris, France. Filed November 28, 1908. The instrument comprises a hollow point having an opening at its rear end for the circulation of air, a body within the point, a metal tube connected to the point, a rod within the tube having one end engaging with the body, electric conductors connected with the tube and with the rod, and a handle of non-heat-conducting material surrounding the tube.

930,212. APPARATUS FOR TREATING GASES BY ELECTRICITY. Ignacy Moscicki, Fribourg-Gambach, Switzerland. Filed August 28, 1906. An electric furnace for the treatment of gases comprises a pair of separated circular concentric electrodes, arranged to form a circular arcing space, means for producing a magnetic field whose flux cuts this arcing space, means for causing a flow of the gases to be treated through this arcing space, and means for supplying an igniting gas to the space.

930,213. SECONDARY ELECTRIC BATTERY OR ACCUMULATOR. Walker Moseley, London, England. Filed March 29, 1909. An accumulator plate consists of a series of conical cups, adapted to receive and hold a semiliquid solution of



930,213.—SECONDARY ELECTRIC BATTERY OR ACCUMULATOR.

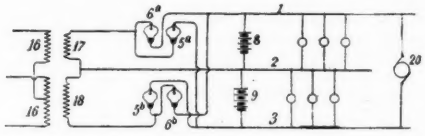
oxide of lead, each cup being provided with a perforated stem, made a little higher than the rim of the cup, vertical rods of lead upon which the cups are threaded, lower and upper bars of lead to which the rods are fixed, and crossbars of vulcanite for supporting the upper bars.

930,238. PRODUCTION OF LONG STABLE ELECTRIC ARCS. Otto Schönherr and Johannes Hessberger, Ludwigshafen-on-the-Rhine, Germany, assignors to Badishe Anilin & Soda Fabrik, Ludwigshafen-on-the-Rhine, Germany. Filed March 16, 1906. The process of producing a long stable electric discharge consists in forcing one part of the discharge away from the other by a current of fluid directed alongside one of the terminals.

930,275. TROLLEY-WHEEL. Erastus E. Ecker, Kansas City, Mo., assignor of one-half to Robert McClintock, Kansas City, Mo. Filed August 18, 1908. Has a main central groove and right and left hand grooves communicating with opposite sides of the main groove.

930,324. ANNUNCIATOR-DROP. Burton W. Sweet, Cleveland, Ohio, assignor to Century Telephone Construction Company, Buffalo, N. Y. Original application filed May 19, 1906. Divided and this application filed February 28, 1907. Comprises a conductive mounting-plate, a pivoted drop thereon, an insulated contact-spring extending freely adjacent to the plate, in position to be actuated against the same by the drop, an electromagnet, and a hook and armature actuated by the magnet and thereby controlling the position of the drop.

930,325. SYSTEM OF DISTRIBUTING ELECTRICAL ENERGY. Percy H. Thomas, Pittsburg, Pa., assignor to Cooper Hewitt Electric Company. Original application filed January 20, 1903. Divided and this application filed May 6, 1903. In combination with three-phase mains and means for deriving therefrom independent two-phase sources, is a three-wire work circuit connected to two of the terminals of the independent sources, the neutral wire of the receiving circuit being connected to the two other terminals of these sources



930,325.—SYSTEM OF DISTRIBUTING ELECTRICAL ENERGY.

and vapor-electric devices connected between each of the outside direct-current mains and each of the first-named two-phase terminals so directed as to pass current through the work circuit in one direction only, together with storage batteries between the receiving circuit mains and the neutral wire whereby energy from either of the independent two-phase sources impresses a constant potential upon one only of the sides of the three-wire receiving circuit.

PATENTS ISSUED AUGUST 10.

930,336. TROLLEY-WHEEL HOLDER. James Barry, Ocean View, Cal. Filed October 18, 1907. Renewed February 20, 1909. A spring secured to the trolley pole holds a pivotally mounted yoke in an elevated position at all times for permitting the wheel to engage a trolley wire, and a spring mounted on each side of the trolley pole engages the side of the frame for checking any lateral movement of the same.

930,337. BRUSH-HOLDER. Norman C. Bassett, Lynn, Mass., assignor to General Electric Company. Filed March 24, 1902. The holder has narrow surfaces (one movable) for supporting a brush on opposite sides of the same, but displaced with respect to each other lengthwise of the brush.

930,351. SPARK-PLUG. Alexander Clarke, Folsom, W. Va., assignor to South Penn Oil Company, Pittsburg, Pa. Filed May 29, 1908. A ball armature loosely mounted in a socket in the plug is magnetically attracted away from a contact point to break the circuit.

930,388. ELECTRIC SIGNALING FIRE-ALARM APPARATUS. William H. Kirnan, Bayonne, N. J. Filed November 7, 1908. A sprinkler system is operated by a thermostat, which also controls an alarm box.

930,404. AUTOMATIC GAS-FEED FOR VACUUM-TUBES. Daniel M. Moore, Newark, N. J., assignor to Moore Electrical Company. Filed May 8, 1906. A thermostat controls means for supplying gas to the tube as the heat of the gas in the tube increases.

930,427. BRUSH-HOLDER. Lorenzo H. Sparks, Warren, Ohio. Filed January 16, 1908. The brush carrier is slidably fitted against a flat face on the holder and a finger on the carrier is acted on by a spring of adjustable tension.

930,449. SNAP-SWITCH. James H. Wyatt, Philadelphia, Pa., assignor to William M. Scott, Philadelphia, Pa. Filed February 6, 1908. Describes the details of a spring switch.

930,474. CURRENT-TESTING DEVICE FOR ELECTRIC BATTERIES. William C. Hood, Chicago, Ill., assignor of one-half to Charles W. Dietrich, Chicago, Ill. Filed March 20, 1908. A battery-current-testing device consists of an insulating support and metal foil mounted thereon of graduated widths at different points.

930,508. RECEIVER FOR HIGH-FREQUENCY ELECTRICAL OSCILLATIONS. Frederick K. Vreeland, Montclair, N. J., assignor to Wireless Telegraph Exploitation Company. Filed July 25, 1905. Two relatively movable coils are arranged in close inductive relation with their magnetic fields mutually opposed, such coils being connected in parallel.

930,512. TELEPHONE-EXCHANGE SYSTEM. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Filed August 4, 1904. Describes the details of a telephone-exchange system, including telephone lines extending to a central office. There may be also included under this classification the following, all by Harry G. Webster and assigned to Milo G. Kellogg: 930,513, filed August 4, 1904; 930,514, filed December 16, 1904; 930,515 and 930,516, filed December 4, 1905; 930,517, filed January 13, 1906; 930,518, filed February 10, 1906; 930,519, filed February 23, 1906; 930,520, filed May 4, 1906; 930,521, filed December 4, 1907.

930,547. APPARATUS AND SYSTEM FOR MEASURING TELEPHONE SERVICE. David S. Hulfish, Chicago, Ill., assignor to American Telephone and Telegraph Company. Filed April 3, 1905. A selective switch is provided with means for automatically selecting an idle trunk line; and a meter connected with this switch, and actuated upon the energization of a relay, is provided with means whereby the meter when once actuated changes its circuit connections and thereby renders itself unresponsive to further action of the relay during the continuance of the connection to the selected trunk.

930,552. RELAY. Jacob M. Long, Los Angeles, Cal. Filed March 4, 1907. Has stationary contact pieces, with which a two-ended contact piece on a rotatable shaft alternately makes and breaks contact when the solenoid is energized and de-energized, upon the opening and closing of an electrical circuit.

930,586. ELECTRIC CURLING-IRON. Charles W. Wilmot, Redondo, Cal. Filed June 17, 1908. Comprises two connected outer heating irons, a relatively movable intermediate heating iron, and a shield or apron connected with the intermediate heating iron and looped over the outer heating irons.

930,588. RECEIVING ELECTRIC SYSTEM. Christoph Wirth and Christof Beck, Nuremberg, Germany. Filed March 18, 1909. Cut-outs for the motors are actuated only when the motors are permitted to run for a sufficiently long time.

930,603. CONTROLLING DEVICE FOR ELECTRIC MOTORS. Charles D. Knight, Schenectady, N. Y., assignor to General Electric Company. Filed February 21, 1907. An electromagnetically controlled switch closes the primary circuit, an impedance is provided in the secondary circuit, and a varying mechanism therefor controls the switch circuit.

930,606. ADAPTABLE TERMINAL CONTACT FOR SAFETY FUSES. Victor F. Morgan, Hartford, Conn., assignor to the Sachs Company, Hartford, Conn. Filed March 7, 1906. An adjustable terminal-inclosed fuse has in combination a tube of insulating material, ferrules on the ends of the tube, and terminal contacts provided with contact arms having a threaded engagement with the ferrules.

930,608. INSULATOR. Louis McCarthy, Boston, Mass., assignor to the Macallen Company, Boston, Mass. Filed October 8, 1908. Comprises metallic connections secured together and insulated from each other by interposed insulation and having a covering of molded composition provided with a projecting portion and a cap secured to one of the metallic connections and having a hub and flange between which the projecting portion of the insulating covering is fitted.

930,609. INSULATOR. Max Neubert and Raymond P. Jones, Glen Jean, W. Va. Filed February 24, 1908. Describes a form of sectionalizing insulator for electric trolley systems.

930,622. MOTOR-DRIVEN FAN. Harry M. Shedd, Roselle, N. J., assignor to Westinghouse Electric and Manufacturing Company. Filed July 27, 1908. Has means dependent upon the oscillation of the fan for imparting limited rotative movements to a shaft centrally disposed in front of the fan and substantially parallel to the pivotal axis of the fan.

930,638. ELECTRIC SMOOTHING-IRON. Alfred O. Whitmore, Salt Lake City, Utah. Filed August 7, 1908. Has a cover or top plate provided with an extension which has an upstanding guard and depending wings.

930,644. SURFACE-CONTACT ELECTRIC-RAILWAY SYSTEM. William M. Brown, Johnstown, Pa., assignor to the Lorain Steel Company. Filed February 20, 1905. Two contact boxes are separated from each other by a distance greater than the length of the car current-collecting device, but sufficiently close together to be spanned by the car magnet. An auxiliary contact device is provided adjacent to one or both of the boxes and electrically connected therewith.

930,666. PROCESS OF TREATING ORES. Paul L. T. Heroult, La Praz, France, assignor to Societe Electro-Metallurgique Francaise, Froges, France. Filed April 19, 1906. The method of treating copper ore containing sulphur consists in feeding it into an electric furnace and fusing it therein and simultaneously injecting oxygen into the ore to oxidize part of the sulphur.

930,674. MANUFACTURE OF RAIL-BONDS. George A. Mead, Mansfield, Ohio. Filed November 2, 1906. Comprises a stranded body portion, stranded terminal members and terminal lugs, all of which parts are separate from each other, and united.

930,675. SAFETY-FUSE. Werner Menzel, Hanover, Germany. Filed August 3, 1906. An adjustable ring is located in a socket and has a notch co-operating with a peripheral ring. A set-screw is provided for locking the ring in the socket.

930,698. TROLLEY-RETRIEVER. Major D. Self, Bessemer, Ala., assignor of one-half to William E. Woodson, Jefferson County, Ala. Filed December 30, 1908. Consists of an air cylinder mounted on the roof of the car, a piston therefor connected to the trolley pole, and a trip rod for the valve also connected to the pole.

930,701. ROTARY FAN. Chester M. Spalding, Schenectady, N. Y., assignor to General Electric Company. Filed December 22, 1902. The armature of a direct-current motor has pivoted to it the blades of a ventilating fan which forces air through the armature regardless of its direction of rotation.

930,704. PUZZLE TOY OPERATED BY STATIC ELECTRICITY. Edward A. Sullivan, Toronto, Ontario, Canada. Filed August 18, 1908. An enclosed casing containing light objects has a glass top adapted for being rubbed so as to attract and move the objects.

930,723. PROCESS OF FORMING ELECTRIC-INCANDESCENT-LAMP FILAMENTS. Werner von Bolton, Charlottenburg, and Felix Hartmann, Berlin, Germany, assignors to Siemens & Halske, A. G., Berlin, Germany. Filed February 3, 1909. Consists in fitting together two tubes of different ductile metals, inserting tungsten powder into the inner one, then working the whole set into filament form and removing the outer metal tubes.

930,727. STORAGE BATTERY. Rufus N. Chamberlain, Depew, N. Y., assignor to Gould Storage Battery Company, New York, N. Y. Filed April 5, 1905. The connecting lug for each group of plates is set on edge close to the inner wall of the jar. This permits removal of any separator or either group of plates without disturbing the rest.

930,728. STORAGE BATTERY. Rufus N. Chamberlain and Herbert E. Pratt, Depew, N. Y., and Albert S. Hubbard, Belleville, N. J., assignors to Gould Storage Battery Company, New York, N. Y. Filed December 17, 1906. Combined with a battery cell is a crate having its walls provided with upright air channels adjacent to the cell and having bottom openings for the admission of air to the channels.

930,738 and 930,739. REGISTERING AND RECORDING MEANS FOR MUSICAL INSTRUMENTS. Benjamin S. Dean, San Francisco, Cal. Filed November 21, 1906. A number of circuits are closed in accordance with the extent of movement of an inertia bar. These circuits control the electrical recording mechanism.

930,746. AERIAL CONDUCTOR. Simon Eisenstein, Kiew, Russia. Filed March 27, 1908. In a system for wireless telegraphy and telephony there is, in combination, a supplementary capacity, an aerial conductor and a self-induction in the form of a lengthening coil in series between the capacity and aerial conductor, immediately below the former and at the top of the latter.

930,750. INSULATOR. Charles M. Graham, Malvern, Victoria, Australia. Filed August 4, 1908. Consists of a bolt secured to the cross-arm, a wooden pin surrounding the bolt, an insulating cup screwed on top of the pin and a porcelain casing screwed over the cup.

930,751. REINFORCED WOODEN SUPPORT FOR INSULATORS. Charles M. Graham, Malvern, Victoria, Australia. Filed August 4, 1908. Renewed April 22, 1909. The wooden pin referred to in the above has a circumferential upsplash preventer.

930,753. MONOTELEPHONE-RELAY TRANSFORMER. Paul E. Heina, Paris, France. Filed March 24, 1908. Consists of a circular plate of iron supported at three points and a lever adapted to oscillate at a slower rate than the vibrations of the plate.

930,754. ELECTRIC CLOCK. Robert D. Hickok, Atlanta, Ga. Filed November 5, 1908. A primary clock controls a number of secondary clocks, whose operating circuits are in shunt with that of the primary clock.

930,761. REGISTERING DEVICE FOR PASSENGER-CONVEYING VEHICLES. Edgar V. Jacka, New York, N. Y. Filed April 22, 1909. An electromagnetically controlled taximeter.

930,772. PROCESS OF CURING MEAT. John C. Lincoln, Cleveland, Ohio, assignor to the Electric Meat Curing Company, Cleveland, Ohio. Filed May 4, 1907. Consists in circulating brine about the meat, cooling the brine in a tank outside of the curing tank and passing an alternating current through the brine and meat.

930,780. MAGNETIC DETECTOR. Joseph Murgas, Wilkes-Barre, Pa. Filed March 17, 1909. A combined condenser and oscillation detector comprises a disk of iron, means for producing a magnetic field, means for rotating the disk therein, a stationary coil surrounding the disk, and a dielectric separating the coil and disk.

930,788. EXTENSION PLUG OR DEVICE FOR CONNECTING ELECTRIC CONDUCTORS. William E. O'Neil, Norwich, N.

Y. Filed March 27, 1909. A spring attachment plug is arranged so it can expand when inserted into a socket.

930,815. ELECTROLYTE. Abraham Van Winkle, Newark, N. J., assignor to the Hanson & Van Winkle Company, Newark, N. J. Filed November 20, 1908. A zinc electrolyte contains fluosilicate of zinc, a salt of aluminum, and a small quantity of gelatine previously dissolved.

930,819. ELECTRIC GENERATOR. Edward F. White, Spokane, Wash. Filed September 12, 1908. A magneto-generator operated by hand through a crank and gearing is mounted with a number of switches and a governor in a closed box.

930,854. TELEPHONE REPEATER. Mark R. Gilson, Philadelphia, Pa. Filed August 8, 1907. Comprises a stationary field magnet, a hollow drum-wound armature, a stationary field magnet located within the armature, and means for destroying residual magnetism in the field magnets.

930,855. INDICATOR FOR SPARK PLUGS. Alfred C. Hall, Sebastopol, Cal. Filed September 25, 1908. Combined with an electric circuit are a spark gap and a reactance coil in series, a second spark gap in shunt with the reactance coil, and a secondary condenser.

930,864. BRUSH-HOLDING STUD. Thomas L. Kearney and Michael J. Kearney, Carbondale, Pa. Filed February 10, 1908. Is formed of insulation with a flat tongue at one end, an attaching device having a recess into which the tongue is fitted, and a fastening passing through the device and tongue for removably securing the parts together.

930,871. TIME-CONTROLLED ELECTRIC DEVICE. Waldron J. Lunger, Elm Creek, Neb. Filed July 24, 1908. An alarm clock has connected with it at the back a shaft and disk carrying adjustable circuit-terminal contacts.

930,873. ELECTRIC COUPLING. Thorvald Maijgren, Rochester, N. Y., assignor to Electro Surgical Instrument Company, Rochester, N. Y. Filed July 10, 1908. Comprises a terminal, an insulator mounted in the terminal, a movable plunger mounted therein and forming the other terminal, and a helical spring surrounding the plunger and holding it in one position.

930,896. ARMORED CONDUCTOR. Edward D. Speer, New York, N. Y. Filed June 27, 1908. A flexible protective covering for the insulation consists of two longitudinally corrugated metal strips arranged one on the other so as to constitute practically a double armor, the inner strip being provided with relatively wide corrugations and relatively narrow beads between the corrugations and the outer strip having a smooth true working fit on the corrugations of the inner strip.

930,902. ELECTROLYZING APPARATUS. Edgar L. Thorp, Nottingham, England, assignor to the British Hosiery and Electrolytic Bleaching Company, Ltd., London, England. Filed November 21, 1905. An electrode is formed of a plate having active sections on one side alternating with active sections on the other side, a covering of insulating material applied over each of the unexposed sides of the sections, the edges of the coverings on opposite sides of the plates overlapping and forming narrow neutral strips covered on both sides.

930,928. ELECTRIC SWITCH APPARATUS. Arthur F. Berry, Ealing, England. Filed April 6, 1906. A solenoid-controlled relay switch has two sets of contacts, movement of one causing a movement of the other.

930,958. ELECTRIC GLOW LAMP. Gustave K. Hartung, New York, N. Y. Filed May 27, 1904. Is provided with a tube in which a current of air through the lamp in contact with the glower is created, a valve or damper in the tube, and means for automatically shifting the valve under variations of the potential of the current supplied to the glower.

930,971. FIRE-ALARM SIGNAL APPARATUS. William H. Kirnan, Bayonne, N. J. Original application filed November 7, 1908. Divided and this application filed February 17, 1909. A number of circuit controllers are arranged to send each a different signal over the circuit when free to act.

930,972. THERMOSTATIC CIRCUIT CONTROLLER. William H. Kirnan, Bayonne, N. J. Original application filed November 7, 1908. Divided and this application filed February 17, 1909. Relates to details of the above.

930,989. CONVERTIBLE SYSTEM OF PRESSURE OR VACUUM CONTROL. Walter J. Richards, Milwaukee, Wis., assignor to National Brake and Electric Company, Milwaukee, Wis. Filed January 25, 1905. Comprises a motor-operated pump, a compressed air reservoir and a vacuum reservoir, a valve for operatively connecting one reservoir or the other with the pump, an automatic switch for closing and opening the circuit of the pump motor, and pressure gauges sensitive to variations in the air and the vacuum tension and thus governing the automatic switch.

930,997. ALTERNATING-CURRENT RECTIFYING APPARATUS. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company. Original application filed March 23, 1903. Divided and this application filed April 30, 1904. Combined with a number of transformer windings connected to a common neutral point and traversed by current impulses of one polarity is a vapor rectifier receiving the current, a consumption circuit connected therewith, and counter-magnetizing coils for the windings traversed by the unidirectional impulses.

931,008. SUBMERGIBLE MOTOR. Augustus C. Durdin, Jr., Chicago, Ill., assignor of thirty-five one-hundredths to Maurice I. Weil, Chicago, Ill. Filed May 18, 1908. A hood surrounds the motor and is adapted to form an air chamber about the same and there are spring clips for positioning and securing the hood upon the motor.

931,013. ELECTRIC HEATER. John E. Macomber, Albany, N. Y., assignor to Consolidated Car Heating Company, Albany, N. Y. Filed April 24, 1909. Is provided with a casing having a transverse end plate and an auxiliary plate superposed thereon and forming a junction box with the end plate and casing.

931,015. INSULATING COMPOSITION. MinDelin McGerry, Kalamazoo, Mich., assignor to Bert E. McDonald, Chicago, Ill. Filed October 5, 1908. A composition for coating wire for insulation consists of asbestos pulp and slippery elm digested to a jelly in a vegetable acid, and mixed with an aqueous solution of glutinous and starchy material.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired August 16, 1909:

480,727. ARMATURE CONDUCTOR AND MEANS FOR INSULATING THE SAME. Emil Kolben, Schenectady, N. Y.

480,728. RING ARMATURE. Emil Kolben, Schenectady, N. Y.

480,729. ELECTRICAL DROP-ANNUNCIATOR. Thomas W. Lane, Boston, Mass.

480,739. COMMUTATOR FOR ELECTROMAGNETIC MACHINES. Horace F. Parshall, Schenectady, N. Y.

480,740. ARMATURE FOR DYNAMO-ELECTRIC MACHINES. Horace F. Parshall, Schenectady, N. Y.

480,782. ELECTRIC LIGHTING SYSTEM. Michael J. Quirk and Christoph Bach, Jr., Milwaukee, Wis.

480,794. ARC WELDING AND HEATING APPARATUS. Philip I. Unwin and Henry Howard, Halesowen, near Birmingham, England.

480,802. ELECTRIC FUSE. Otto T. Blathy, Buda-Pesth, Austria-Hungary.

480,804. ELECTRIC DISPATCH SYSTEM. Andrew Bryson, Jr., New York, N. Y.

480,845 and 480,846. ELECTRIC ELEVATOR. Frank E. Herdman, Indianapolis, Ind.

480,850. ELECTRIC RAILWAY. Rudolph M. Hunter, Philadelphia, Pa.

480,884. BATTERY CELL. Edward P. Usher, Grafton, Mass.

480,885. STORAGE BATTERY. Edward P. Usher, Grafton, Mass.

480,886. BATTERY PLATE. Edward P. Usher, Grafton, and William F. Draper, Hopedale, Mass.

480,887. BATTERY PLATE. Edward P. Usher, Grafton, Mass.

480,888. ELECTRICAL MEASURING INSTRUMENT. Edward Weston, Newark, N. J.

480,889. APPARATUS FOR RETARDING OR DAMPENING THE MOTION OF MOVING BODIES IN ELECTRICAL INSTRUMENTS. Edward Weston, Newark, N. J.

480,890. ELECTRIC TIME-INDICATING APPARATUS. Edward Weston, Newark, N. J.

480,891. TEMPERATURE-REGULATING DEVICE FOR ELECTRICAL CIRCUITS. Edward Weston, Newark, N. J.

480,892 and 480,893. RHEOSTAT. Edward Weston, Newark, N. J.

480,894. 480,896, 480,895, 480,897, 480,898 and 480,899. ELECTRICAL MEASURING INSTRUMENT. Edward Weston, Newark, N. J.

481,030. METHOD OF ELECTRIC WELDING. Henry Howard, Halesowen, near Birmingham, England.

481,062. ELECTRIC CONTROL OF RAILWAY TRAINS. Robert C. Sayer, Bristol, England.

481,075. ELECTRIC BATTERY. Peter Stiens, Charlottenburg, Germany.